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ARCHITECTURE

ENGINEERING

DECORATION

CONSTRUCTION

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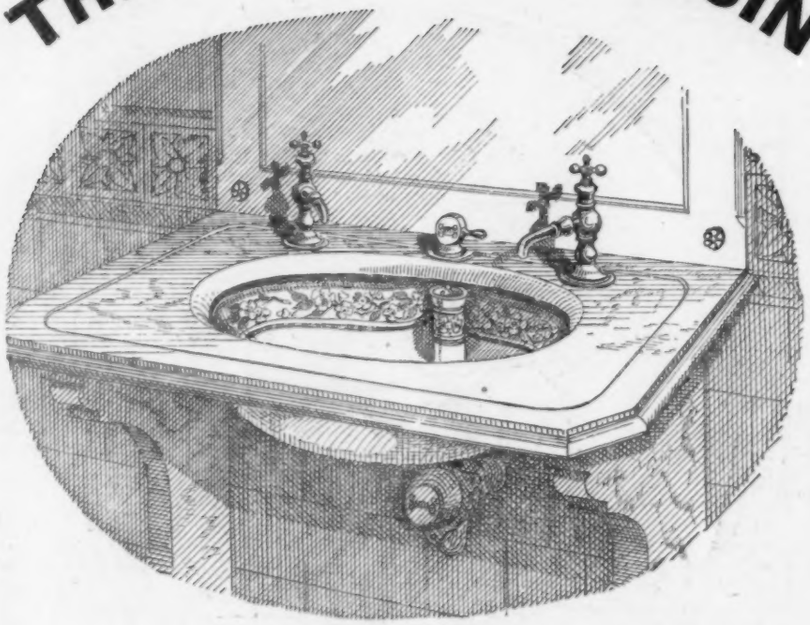

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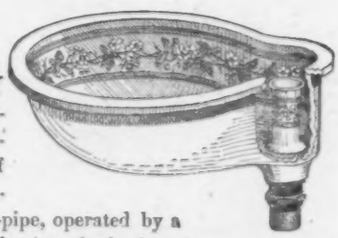

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WE print in another column a letter which, although not intended for publication, serves better than anything we could say to show how much strength the movement to place the architect in a better position than he now occupies in regard to supervision has already acquired in the profession. It is only by letting people, in some such way, understand how many others are ready to support them in any definite step which may be taken in the matter that a movement can be made with unanimity and success, and we hope that there will be enough architects willing to take the lead in each locality to carry it out firmly and judiciously. As we have already said, we believe that the public is willing and ready to provide and pay for clerks-of-works to attend to the minute details of supervision, so that architects may have time to do the higher work of planning and design to which they have been trained, and in which they can be of most service to their clients. To cite a single example, Mr. Keely, of Brooklyn, is said to have had more than fifty churches in progress at one time, and it is due to his industry and talent to say that all of them, if we may judge of those we have seen, were very far above mediocrity in design. Now, his buildings being scattered all over the country, it is probably quite safe to say that his visits of superintendence occupied, on an average, three days each. If he did nothing else but superintend, he could not see his churches oftener than once in six months all around, and, if he devoted half his time to designing, the visits of supervision would be annual. This would be practically no supervision at all, as it would amount to only one, or, at most, two inspections during the whole period of the execution of the work, yet there can be no doubt that his clients, if they were consulted, would wish him to give less, rather than more, time to supervision. They would say, with reason, that if he could not both plan and supervise, they preferred to have him keep to the former. They could easily hire some one to show laborers how to mix mortar, but only one man could design Keely's churches; and, as they wanted his design at its best, it was good policy for them to relieve his mind of the burden of a duty which he could not properly attend to, and thus gain time for him to devote to perfecting his special work. Although few architects have so many professional engagements as Mr. Keely, most of them are distracted in the same way between the necessity, enforced by a terrible responsibility, of sacrificing all other work to visits of supervision, and the desire of their artistic nature to study over their designs and work them up gradually toward perfection. At present, a few men, like Mr. Richardson and one or two others, have been bold enough to refuse to undertake responsible superintendence, and to claim the whole of their own time for the artistic development of their ideas; but the public certainly has not deserted them, nor would it, we think, be at all likely to desert other architects who might follow their example.

THERE is, moreover, another consideration which would lead the public to look with favor on the permanent abandonment by architects of the rôle of bricklayers' and plumbers' and tinmen's and carpenters' and painters' and mortar-mixers' "spotter," in the obvious injustice done by the present state of the law in regard to their responsibility. It is not many days since a lawyer, who had had a good deal of experience in building cases, told us emphatically that, if he were an architect, he should put all the money he earned into investments in his wife's name. The risk, he thought, that an architect ran of being reduced to poverty at any moment by the whim of a client who chose to visit on his head some real or pretended grievance that he had suffered from a builder was too great to make it safe for him to hold any property in his own name. We venture to say that many other lawyers would say the same thing, and the intelligent part of the public would agree with them; and, as the natural sense of fairness and justice which prevails in the community revolts at the idea that any class of men so useful and hard-working as architects should be debarred from accumulating property for themselves by the imminent risk which they ran of having it taken away from them and used to fill voids in other people's pockets which they did not make, an effort to set the profession right in this respect would be heartily seconded by all decent persons. As we have already said, the present system of expecting American architects to be their own clerks-of-works, and to be personally responsible for the testing of every barrel of cement, the mixing of every batch of mortar, the laying of every brick, and the quality of every timber in all the buildings they design, is ruinous to the architects, whose time it consumes with petty details with which they should have nothing to do, while it wears out their lives with anxiety; it is in the highest degree injurious to American art, since it forces the skilled architect, by a sense of the risks to which he is exposed, to spend nearly all his time in such supervision, and to leave the design of his buildings, to which no pecuniary penalty is attached, to his draughtsmen; and it is detrimental to the client, whose work would unquestionably be better done if it were under constant supervision, but who does not and cannot get such attention from the architect himself, while the frantic efforts of the latter to come as near such supervision as he can, diminish greatly the care and study which he is able to give to the plans. We have seen, since the present discussion began, an article in a daily paper, informing its readers that the architects had in contemplation a scheme for extorting money from the public by means of clerks-of-works, and calling upon all persons interested to combine to force the architects to furnish clerks-of-works on all their buildings at their own expense. It is hardly necessary to say that the editor of the paper in question is probably the only person who holds the views he expresses. In all other civilized countries, and to an increasing extent in this, clerks-of-works are appointed and paid by the owner, to guard certain of his interests which the architect is not asked or expected to take care of. If architects were to be required to pay clerks-of-works out of their present meagre fees, the profession would be vacant in a week, and would remain so until the public came back to the idea that architects could do something for it that it wished to have done, and would do so on being properly treated and properly paid, but not otherwise.

IT would be singular if Boston, which is not at all an artistic town as compared with New York, should become more favored by artists than any other place in the country; yet it is by no means certain that this may not happen. It is unquestionable that the establishment of the Rotch Architectural Scholarship, by the generous children of the late Benjamin S. Rotch, has brought to or retained in Boston a considerable number of the most earnest and able students of architecture in the country, who have sought an opportunity of qualifying themselves, by the necessary two years' employment in a Massachusetts architect's office, to compete for this splendid prize. As a result of this, the Rotch Scholarship has been taken, in three years out of the four in which it has been awarded, by men from out of the State, who have spent little more than the minimum of time allowed in Massachusetts offices, while scores of others, who have the scholarship in view, are working industriously at their professional studies, to the advantage of the city and State, as well as of themselves. Within a short time a sim-

ilar travelling scholarship has been established under the direction of the School of Drawing and Painting of the Boston Museum of Fine Arts. This scholarship is limited to residents of New England, under thirty years of age, who are students of painting, intending to devote their lives to the practice of this as a profession, and who are dependent on their own exertions for support. The successful candidate in an examination which includes drawing from the living model, sketching a composition, and painting a head from life, will be paid an allowance of six hundred dollars a year for three years, on condition of passing this period in diligent study in foreign schools of painting. To our mind, nothing has ever been done which will accomplish so much as this for art in America. Some one once said, in remarking upon the high degree of talent and learning among the Episcopal clergy in England, that although the great body of them were no better paid than the clergy of other denominations, the ranks of the ministry were kept full of men of ability and education by the small number of great prizes, in the shape of bishoprics, and other dignified and well-paid appointments, which were open to the best among them. Although not one in a hundred of the clergy would ever really become a bishop or a dean, the possibility was open to the humblest curate, and this possibility would cheer and encourage all the curates in the Church, as well as the young men who had a profession to choose. So the students of painting in New England, who find discouragements enough in that inhospitable clime to chill the courage of a Michael Angelo, will now have something to live and hope for, which will increase their ardor and determination tenfold. It is not the decorators of teapots, or the workers in pen-and-ink upon holly-wood fans, who will enter the lists for such a prize. They much prefer the adulation of their female friends to the fierce tumult of competition, and will leave the field clear to the people of real ability, who will know how hard they must work to win, and will gain in vigor of mind, in certainty of hand, and in habits of industry, by their efforts. In these alone every competitor will secure a great prize, but for the winner the scholarship offers as unalloyed happiness as the world has to bestow. To draw and paint is enjoyment, and to draw and paint well is a great pleasure, but to draw and paint so well as to have earned the right to go and live for three years among the best pictures, and learning from the best masters, without being hampered by the sordid cares and anxieties which distress so many students, is an object worthy to call out the best efforts of the ablest men, and we should certainly add, of the ablest women, for, judging from the exhibitions, there are few points in which the best women students are not already as skilful as any of the men.

A CURIOUS panorama is to be provided at the Paris Exhibition next year, by the Compagnie Générale Transatlantique, to represent its fleet of steamships. The panorama, or, as we have been taught to call it, cyclorama, is to be painted by M. Poilpot, who, we are told by *Le Génie Civil*, has already painted such views to illustrate the War of Secession in the United States, and, for all we know, may be identical with the eminent M. Philippoteaux, familiar to the American public as the artist of the "Battle of Gettysburg," the "Siege of Paris," and other cycloramic works which have made the tour of the United States. The Compagnie Transatlantique's cyclorama is to be mounted in a circular building by itself, and affords some novel effects. The spectator, on ascending the stairs, emerges upon what appears to be the deck of one of the newest and largest steamers of the fleet, the "*Touraine*," which is now in process of construction. Around him are the masts and rigging of the vessel, and he can hold by the shrouds and look over the bulwarks at the sea, which extends to the horizon. On one side can be discerned the red roofs of Havre, and lying at anchor at different distances are the other ships belonging to the Company, while the illusion is heightened by the mists which obscure the background. In order to surprise and dazzle the spectator, which is important to the effect of a panorama, an ingenious device is used to detain him in the dark passageways leading to the fictitious ship's deck, in the shape of dioramas, or illuminated pictures, to be looked at through a lens fixed in the side of a box. Seven of these are provided, representing the ship-building yard of the Company at St. Nazaire, the embarkation of emigrants, and various scenes on board one of the great vessels during a voyage. All of them are interesting, and the visitor moves slowly through the darkened passageway, looking successively into the lenses, until his eyes have become accustomed to the feeble light, and the pupil has expanded so much as to be quite overwhelmed with the brilliancy of the great cyclorama, on emerging upon the platform.

THE description of this cyclorama serves as the text for an interesting history of panoramas in general. Their first invention is due to a Scotch painter, Robert Barker, who, while in prison for debt, attempted to read a letter by the light that came through the tiny loop-hole of his cell, and was struck by the singular effect of the illumination upon the paper. He studied the phenomenon carefully, and on his release from jail, in 1796, he undertook to utilize his observations by exhibiting a picture under artificial illumination. Three years later he brought out a panoramic picture of London, which had great success, and was followed by similar views of Portsmouth Harber, and other scenes. Robert Fulton was in England at the time, and, immediately on the production of the London picture, conceiving that the idea would be successful on the Continent, took out a patent for it in France. He had several panoramas painted in Paris, by Prévost and Constant Bourgeois, representing the cities of Amsterdam, Rome, Naples, and so on, the Camp of Boulogne and the Battle of Wagram. In 1810, Napoleon, with characteristic quickness in converting to his own benefit any new idea that might be of service to him, observing the interest taken by the public in Fulton's battle-scenes, ordered the architect Cellerier to prepare a scheme for seven panoramas, representing his own victories, which he proposed to have carried about and exhibited all over France. Unfortunately, just as the plan was matured, Napoleon himself was captured and carried off to Elba, so that the demand for panoramas of his victories declined, and Prévost, who would probably have been the painter of them, was obliged to content himself with exhibiting, as a private enterprise, some views of Athens, Jerusalem and Antwerp. Since then, panoramas have always been popular in Paris, and such renowned artists as Détaille and Alphonse de Neuville, among others, have taken pleasure in painting them for the public. The best of the French ones usually either come to this country or are sent to Russia, after the Parisians get tired of them, and the English and Germans have some of their own, which they find pleasing.

IN answer to a question of a correspondent, M. Collet-Corbinière writes in *La Semaine des Constructeurs* an interesting essay on the law of France in regard to payment for extras on contracts. The correspondent in question, a builder, contracted to erect a house according to certain plans and specifications, which showed and described a fence sixty feet long, and a corner tower, two stories high. As the work went on, the owner wished to have the tower made higher, and the accommodating builder carried it up two stories more. He wished also to have the fence extended to one hundred and fifty feet, and three gates put in it, all of which was done. The builder then asked, on his side, to be paid for all this extra work, and was told that no written orders had been given for it, and, under the law, the owner was not bound to pay for it. M. Collet-Corbinière naturally sympathizes with the contractor, but replies that the law is plain. Under the Code Civil a man who contracts to build according to a definite plan, and for a fixed price, cannot demand any increased price, under any pretext, on account of changes or additions, unless such changes or additions are ordered in writing, and the price for them agreed upon beforehand with the owner. The only occasions on which the courts have varied from this rule have been those where the contract was not a perfectly definite one, so that it did not answer to the description in the Code, and these exceptions are rare. He therefore advises the sufferer not to try to evade the law, but to set himself to examining his plans and papers, to see whether he cannot find some letter, or marginal note on a drawing, which will answer as a written order under the law, or will, at least, so far imply an order that the written memorandum may be explained by oral testimony in court, and, so explained, be enforced as if it were written out in full. M. Collet-Corbinière does not say whether drawings or sketches are in France considered to be written orders within the meaning of the law, but we infer from certain points in his letter that they are not. In this country they would be so considered, and if the builder could find sketches made by the owner, and showing the modifications as carried out, he would be pretty sure of getting his pay, whatever the contract might say about requiring orders for extra work to be in writing.

ARCHITECTURAL EDUCATION IN THE UNITED STATES.[1]—IV.

COLUMBIA COLLEGE, NEW YORK.

A Roman Fountain.

IN the year 1881, Prof. William R. Ware, at that time in charge of the Department of Architecture at the Massachusetts Institute of Technology, was invited to undertake the formation of a similar department in connection with the School of Mines, Columbia College. Previous to this there had been no regularly organized school of architecture in New York City, though the necessity therefor had long been felt, and the Trustees of Columbia College were quite ready to do anything in their power to place the department on a proper footing, and to equip it in such a manner as to enable Professor Ware to carry out his ideas and to give the proper stability to the institution. Mr. Augustus Schermerhorn, one of the Trustees, provided the means for the greater portion of the equipment, something like ten thousand dollars being expended under Professor Ware's immediate direction. The portion of the College buildings in which the department is now installed was erected subsequently to Professor Ware's appointment, and was, consequently, arranged in deference to his wishes, so as to give the best results for drawing-rooms, library, etc., and was intended to be as nearly perfect as possible.

The department has two assistant-professors, who have charge of certain lectures, etc., one draughtsman, and one librarian.

The attendance is obligatory in all cases. For convenience, the course has been divided so that the students are grouped in three classes, the third and fourth year men studying together. There are no special students or special courses, as such; but any one entering the College on advanced standing may be allowed to pass examinations upon the studies of the first year, and, during the remainder of the year, can follow any studies he chooses, as extras. He may thus, though not recognized as a special student, pursue special studies.

The regular course of study during the first year is practically the same for all the departments of the School of Mines, and involves simple mathematics, physics, and a certain amount of elementary drawing; but the latter is entirely separate from that of the other courses, and includes shades and shadows, drawing from the cast, and brush-work. The studies for the succeeding years are as follows:

COURSE IN ARCHITECTURE.

SECOND YEAR.

Graphical Geometry.
Graphics — descriptive geometry.
Elements of Architecture: forms and proportions of the five orders and of balustrades, doors, arches, etc.
Ancient Architectural History.
Applied Chemistry: air, water, artificial illumination, photography, cements, timber and its preservation, pigments, glass, etc.
Drawing: tracing ornament, plans, sections and elevations, details, perspective.

THIRD YEAR.

Mechanics.
Sanitary Engineering.
[2] Mediæval Architectural History.
[2] History of Ornament, lectures and exercises.
Theory of Architecture.
[2] Specifications and Working-drawings.
Architectural Design.
Geology.
Drawing: from the cast, ornament and figure.

FOURTH YEAR.

Civil Engineering: theory of strains and strength of materials continued.
Graphical Statics.
Sanitary Engineering.
Sewerage.
[3] Business relations between architects, clients, mechanics, and draughtsmen; office papers; competitions; legal obligations; superintendence.
[3] Estimates.
[3] Modern Architectural History.
[3] The History of Painting and Sculpture.
[2] The Decorative Arts; lectures and sketching; excursions.
[3] The Theory of Architecture — the theory of color, the theory of composition.
Literature and Criticism: themes, reports; abstracts of books.
Economic Geology: clay, limestones, cements, building and ornamental stones.
Architectural Design: problems.
Project.

In regard to what might be termed the practice of construction, as distinguished from the study of theoretical construction, the ground is taken that it is not the business of the school to teach what can be better learned in architects' offices. Still, an hour a week is given to a course of lectures upon specifications, estimates, etc., as shown in the programme, and there is in the department a carefully prepared series of drawings illustrating all the ordinary constructions, which the students copy and trace at their leisure, by way of preparation for office-work, though no examinations in this work are exacted. The lecture on specifications is followed by an afternoon's work in figuring, estimating, etc. The study of scientific construction is pursued mostly in connection with the engineering departments of the School of Mines. It is intended, subsequently, to bring these into the architectural department as far as possible.

To aid in the study of specifications, a model has been prepared after consulting a great number of specifications which have been used on actual work. This model is copied by each student into a book, the copying being put on one side of a sheet only, and subsequently filled in with notes, queries, etc., which suggest themselves to the student at the time, or may come up later as a result of intercourse with practical work. In addition to this, there are, every year, lectures on quantities and estimates, given by some regular practitioner; and a part of one year is given to the study of Professor Clark's work on "*Building Superintendence*," which is read and commented upon by the class.

In the first year, as previously stated, the only architectural work is in the line of elementary free-hand and mechanical drawing. In order to start the students in right lines, a number of methods are followed. The first exercises consist in copying drawings in plain washes. Then, in order to relieve the monotony of plain copying, and to encourage the students to think for themselves and to use the different mediums, they are required to make, as it were, translation drawings; that is, an engraving or photograph is given to be copied in India ink or reproduced in crayon, so that the students' appreciation of the values of different mediums will be developed. There is, also, a certain experience given in water-coloring from black and white drawings, and the student is instructed in the use of drawing instruments and in simple pen-work. All of this is during the first year, and is in addition to a limited amount of cast-drawing, shades and shadows, and perspective.

The architectural drawing in the second year is carried on as an adjunct to the theoretical instruction. The orders are studied very thoroughly in connection with lectures on the elements of architecture, so that the student has careful drilling in proportions, forms, etc. The subjects illustrated in the lectures are subsequently drawn out on the black-board by the pupils, criticised in the class, so that each gets the advantage of the work of the whole, and finally are drawn out in pencil, but not inked in. This is varied by exercises calling for the application of principles previously discussed in lectures, such as the drawing out of a portico, an arcade, or a vault. At the same time, there are lectures and illustrations on practical problems in shades, shadows, and perspective.

The third and fourth year students are united in a single class. The drawing consists of illustrations of the "History of Architecture," drawn after the lectures in the same manner as during the second year, together with a stated number of problems in design, carried forward in much the same manner as is followed in the School of Fine Arts, Paris, the problems being stated to the class, sketches submitted and *rendus* studied out in regular order, the work of each student being discussed and criticised in such manner that the whole class gets the benefit of the training of each individual. Besides this, there is a considerable amount of drawing from the cast. The department is supplied with a number of small casts, which are given out to the students once or twice each week to take home to draw from by gas-light. This exercise is found to be of great value.

The first of the purely theoretical studies taken up in the course is the "Theory of Architecture." This is intended to be more negative than positive in its nature, and is designed to help the student to discriminate and to use his judgment. One hour each week is given to the study. In the first term the line of beauty is discussed, the theory of proportion, symbolism, and the use of natural forms in their relation to architectural design. The lectures are fully illustrated, the aim being always to awaken thought in the mind of the pupil. In alternate years lectures are given on "Color," with illustrations from the Department of Physics. In the second term the allied arts are brought up in their relations to architecture, illustrated and discussed in the same manner as the general principles previously considered.

The lectures on "Ornament" are prepared in a manner which commends itself at once as being calculated to draw out individual thought on the part of the pupil. A syllabus covering the general points of the lectures is prepared and printed. Each week, one student is assigned the lecture, and is expected to consult his classmates' notes, as well as his own, to examine such authorities on the subject as he may desire, and write a full report of the lecture. The written sheets are hektographed and distributed to the members of the class.

In the study of the "History of Architecture," ancient work, including the early Christian epoch, is taken up during the second year, Mr. Clarke's translation of Von Weber's "*History*" being used as a text-book. One hour's lecture and one hour's recitation is given to this each week. To fasten the dates and the facts in the minds of the students, Professor Ware has prepared a set of architectural tables, which are given to the students to be committed to memory. In the third class, extending through the third and fourth years, Gothic and modern history are taken up alternately. In this department Professor Ware met with a difficulty which every teacher has doubtless encountered. The students, while faithfully following the mere lessons, would utterly fail to grasp the sequence and significance of what had been put before them; so that while the final examination papers showed a considerable degree of book-learning, the students had little real knowledge of the history of architecture. A better way was accordingly devised, and is now followed. In the first term the whole subject of either Gothic or modern architecture is skimmed very hastily by topics, without dwelling on special points,

[1] Continued from No. 667, page 157.

[2] For convenience these subjects are given in alternate years, the third and fourth year students taking them together. In 1887-88 both classes take the work here set down for the fourth year; in 1886-87, that set down for the third year.

[3] For convenience these subjects are given in alternate years, the third and fourth year students taking them together.

but simply outlining the study. The subject-matter is then divided into half as many topics as there are students in the class; and, as the end of the term approaches, two students are assigned to each topic, to study it up, examine it and write essays upon it. The next term, these topics are taken up in succession week by week, the essays read by way of introduction, and the whole class gives its time to further elucidation and illustration. To this end, the books and photographs in the library bearing on the general subject are divided into groups, to each of which two students are assigned, to exhaust it and report what they may find at the end of the week. The next week two more essays are read, introducing another topic; the students move on to a fresh group, and another series of reports are prepared. In this way, each student is obliged to know thoroughly at least one important topic of the period of history the class is studying; and, as the groups of books are moved along from week to week and assigned to different pupils, it follows that at the end of the term each student has looked through the entire contents of the library relating to the period under investigation, and is reasonably familiar with what can be found there.

A very interesting feature of the department is the attempt which has been made to encourage work on the part of the students during the long summer vacation. According to the regulations of the School of Mines, each student is obliged, at the beginning of the fall term, to present a thesis upon a certain amount of work done during the vacation. In the department of Architecture, instead of a thesis, each student is required to present on the first of October, one hundred sketches made during the vacation. No restrictions are made as to the kind or nature of work — simply that there shall be one hundred sketches of some sort. The results have shown that the students are not inclined to slight the work, but, on the contrary, exert themselves to see who can present the best, and some of the summer work thus prepared has been of considerable artistic value. The only limitations are that the student shall include the plans, sections and details of some one house. If the student, instead of sketching, prefers to spend his time in an architect's office, he is encouraged to do so, and each day in an office is counted as equivalent to one sketch. The results thus far in regard to vacation work have been entirely satisfactory.

There are a few special features in connection with the department which are worthy of note. Columbia College requires a certain knowledge of French in order to pass the entrance examinations, but students seldom are able to properly use the French books in the library. To aid them to a better acquaintance with the language a scheme has been devised which has been found to work admirably. Two hours a week have been given to it during the first year. Maspero's "*L'Archaeologie Egyptienne*" was selected for reading. A page is assigned to each member of the class, and at the recitation, is first read aloud by the pupil, then translated and then re-read. Each student is required to have his copy of the book with him and to make marginal notes; and it therefore follows that very few expressions will fail to be appreciated. In fact, it has been found that in this way the student acquires a familiarity with the language in a very short time, as each is enabled to profit by the other's mistakes and is also obliged to thoroughly study a definite portion of the work each week.

An exercise which has been found of great value, is somewhat as follows. Photographs of buildings are given to the members of the class, each of whom is required to write out a careful description stating the character of the building before him, the kind of windows, the mouldings, etc. Then the students exchange descriptions, and, without knowing the original, make a drawing from the description. Finally, the drawings and descriptions are compared by the class, and criticised.

Besides the lectures on hygiene and kindred topics which are given to the entire third college class, a special course in Sanitary Engineering is given to the students of architecture. This covers, in the third year, the drainage of buildings, the arrangement of pipes and fixtures, the disposal of household refuse, and the drainage of cellars and grounds. During the fourth year, the ventilation and warming of buildings is taken up, and discussed from both the practical and the scientific points of view.

In view of the circumstances under which the department was founded, it will readily be understood that the equipment is all that can be desired. Professor Ware has not been stinted in money nor in encouragement, and he had everything he could need to make the work a success. The drawing-rooms are large, well lighted, and arranged to give the students the best facilities for consulting the library, working in the modelling-room or attending recitations. Modelling, however, is purely an extra at present, though the opportunities are open to those who wish to avail themselves thereof. The main library of Columbia College contains 80,000 volumes, besides American and foreign periodicals, etc., forming a very rich collection for general reference. In addition to this the department of architecture has a special library of about 300 volumes, carefully selected by Professor Ware, intended to be exhaustive in its nature and to include all of the best professional works. These are kept in a room adjoining the drawing department and are at the disposal of the students at all times. Books may be taken away from the building under special conditions and everything is done to encourage the students to use the volumes constantly and to draw from them as freely as possible. There is also a collection of water-color drawings and colored prints, used for copies, and about eleven thousand photographs, which are mounted on loose sheets and kept in portfolios. The students are allowed to use these photographs as they please, to take them from the shelves, and to have them beside their work, but are not allowed to put any of them back on the shelves. One of the attendants goes around the room at stated intervals and collects all the photographs not in actual use, restoring them to their proper places, so that they do not become misplaced, but can readily be found when wanted. The department has also a limited number of models, mostly of the orders.

The requirements for admission to the department include a knowledge of arithmetic, geometry, algebra, rudimentary physics and chemistry, French, German, book-keeping, and free-hand drawing sufficient to sketch ordinary objects. The number of students at present is fifty-four, and there have been about sixteen graduates, three of whom are practising architects in New York City and all the rest are in New York State. The graduates' degree is that of Bachelor of Philosophy.

The expenses for attendance at the school are as follows:

Matriculation fee	$5.00
Annual Tuition	200 00
Text books, first year	15.00
" second year	30.00
" third year	50.00
" fourth year	20.00
Materials, $15 to	25.00
Graduation fee, with diploma	30.00
Total	$375.00

Add to this, board outside of the college at from $6.50 to $10.00 per week and the total expense for the course is from $560.00 to $700.00.

Free tuition is offered upon the following conditions:

1. The applicant must present a certificate from some person of good repute, stating that he is of good moral character and studious habits; also that he is unable to pay the tuition fee.

2. He must exhibit a proficiency in every subject of examination for admission of six on a scale of ten.

3. He must maintain an average standing of seven in every subsequent study, or an average of eight in all the studies for the year.

4. He is not exempted from fees for matriculation, for extra examination, and for graduation.

LIBRARY BUILDINGS.

I READILY accede to your request for a further treatment of this subject, in the interest of a better understanding between architects and librarians.

In answer to the statement that librarians disagree among themselves on this subject, so that no consensus of the views of the profession is available, I asserted that certain well-defined principles have been laid down by a practically unanimous agreement of librarians, which principles are constantly violated by architects and building-committees through their failure to learn of these facts, or to appreciate their bearings.

In the Library Conference held in Boston in 1879, Mr. Henry Van Brunt said: "Doubtless we made a false start by endeavoring to adapt our large public collections to the traditional and architectural library halls, surrounded by chapel-like alcoves, in several stories." And again: "The purposes for which our own public libraries are established are new to the world of literature and books, and naturally affect the question under consideration."

In just this line the Library Association voted two years later, 1881, at Baltimore (and without a dissenting voice):

"*Resolved*, That, in the opinion of the Association, the time has come for a radical modification of the prevailing typical style of library building, and the adoption of a style . . . better suited to economy and practical utility."

Unless both my memory and my examination of the *Transactions* of the Library Association are at fault, no one member has since, by voice or vote, favored in our conferences the "traditional and architectural library hall" style of building, and it should by this time be well understood that that style is not in favor with those most conversant with modern library wants. Perhaps the reply will be that it is easy to condemn that form of building, but more difficult to find a satisfactory substitute. But substitutes have been found, and while there is a difference among librarians as to which is best, they have features in common that represent the settled views of the mass of librarians. Mr. Van Brunt's criticism of the ancient style of building, quoted above, was made in connection with an account he was giving of the then new "stack" at Harvard, an arrangement which he had planned for obviating the objectionable features of the old style. In the stack, we have rows of iron bookcases placed as

near together as is consistent with convenience of passing between them, and running from floor to ceiling of a room some fifty feet high; light open iron-work floors being introduced at intervals of seven and one-half feet, so that every shelf may be easily reached from them, avoiding altogether the use of step-ladders. The walls, not being used for shelving, are pierced with numerous large windows, pouring a flood of lateral light into the stack, which is also lighted from the roof. Space for readers' small tables is provided on each floor, distributed so that facilities for the use of the books may be found very near every shelf in the library. As compared with the old conventional library building, the stack has the advantages of greatly increased book-room per cubic foot of space within the walls, increased facilities and improved conditions for the use of the books, and a much greater supply of light.

But the stack-system is only one way of gaining these advantages. Another method is prominently before the library profession, largely through the able advocacy of Dr. W. F. Poole, of the Newberry Library of Chicago, a method which has not quite all the advantages claimed for the stack, but which claims others that are wanting in it. It is what may be called the single-floor system, allowing only one range in height (say seven feet) of shelving to be placed in one room, an equal or greater space being left above for the proper diffusion of air and light.

In the great majority of cases, library buildings are erected where land is not expensive and a large floor-area is available. Where this is the case, a library of very considerable size may be shelved so as to obviate entirely the need of steps and stairs; and, where land is more expensive, one such floor may be placed above another indefinitely at intervals of fifteen feet, elevators putting them practically on one level. It is claimed for this single-floor system that the superior supply of light afforded through its admission by high windows above the top of the book-cases, with nothing to intercept its fall between and around them, and the fact that no books are placed near the top of a room to their own injury by heat and gases, and to the serious discomfort of the users, more than atone for the failure to utilize, as does the stack, every foot of perpendicular space for book-storage.

However this may be, the discussion among librarians now is between these two systems in their main features, and all agree in requiring that a library building shall have, in one or the other form, the advantages common in some degree to both; viz., great capacity, abundant light, convenience of use.

It is when we turn from our little differences of opinion as to which ways are best for securing these ends, to such buildings as the Winn Library at Woburn, Mass., and the Howard Library at New Orleans, that we leave our mutual bickerings and join in deriding the poor architect. In these two beautiful buildings we find the old "traditional" style in its glory, with its alcoves, its high step-ladders, its galleries (and even step-ladders in the galleries), its narrow windows, one in each alcove, shedding a dim religious light into the interior, its large tables running down through the nave. In the Howard Library (unless recent changes have been made) the windows are eighteen inches wide, and pierce a three-foot wall (two feet of stone and one of bookcases), and a person to go from the alcove behind the desk to the gallery immediately above it must travel the whole length of the room twice, besides ascending the stairs, and perhaps a step-ladder, too. Well might he say to the book just over his head, "Thou art so near, and yet so far!" In this same building, I believe, the only way a place could be found for the librarian and assistants to work was to fence off one alcove.

Provision for efficient and economical administration is one point with regard to which it is plain that no architect could go right without definite instruction as to the method of administration to be employed in the building. Such instruction architects are quite apt to be without, for the reason that no one is on the ground who is competent to give it. Almost every public library has these departments more or less fully developed: reference-department, circulating-department, and reading-room. The erection of a new building should facilitate the due development of these three departments, in strict relation to each other and to the special wants of the particular community, and with a due regard to the means likely to be at hand for supporting the administration. If one person be expected to supervise more than one department, these departments should be so arranged as to make that feasible. I hope I shall be pardoned if I attempt to illustrate this point by commending the arrangement of the Amherst College library, especially as it was all done before I ever saw Amherst.

Our present library building is a re-arrangement of an older one, with the addition of a new wing for the book-stack. The library and reading-room are on the second floor, the lower floor being used for secondary purposes. At the top of the staircase one enters the delivery-room, facing the counter of the attendant, who has been able to observe him almost from his entrance upon the stairs. At his right he finds the large reading-room, nearly the whole of which (the wide doors always standing open) is under the eye of the same attendant. At his left are the card-catalogue cases and a shelf of indexes, etc., with a little space for their convenient use, furnished with tables and chairs. Through the counter is a gateway, admitting, under the surveillance of the same attendant, to the entrance of the stack, which (being on the second floor of the main building) he enters midway of its height, and finds himself as centrally located as he could be in the library itself. Never, I believe, was a library better arranged to enlarge the scope and usefulness of a single attendant. Except as pressure of work calls for assistance, he easily attends to all the three departments of reference, circulation, and reading-room. My moral is that this could not have been provided for without intelligent understanding of the administrative functions of the library, and it should be stated that the architect was a graduate of the college, who had freely used, and taken a deep interest in, the library.

But when the different departments of a library have been arranged with reference to an efficient and economical service, there is yet to be made provision for the work which must be done "behind the scenes." Books will be received in cases and parcels. They must be delivered at a rear or side entrance, opened in a suitable room, where some dust and dirt will not be seriously objectionable, spread out on tables in an adjoining room for examination, cataloguing and labelling, and then sent to their places in the library. No problem is more difficult, perhaps, in the arrangement of a library building than that of placing the librarian's own office or desk, which on some accounts needs to be in close contiguity to the public part of the building, accessible to those needing his guidance in their reading, and on other accounts should be near the place of receipt of new books. Hardly any two libraries or two librarians would agree in their requirements in this line; but, if it is once clearly seen by architects that no library building can be a success in which some provision, in accordance with the circumstances of the particular case, is not made for these various needs, they will soon fit themselves to deal with the problems involved, and will doubtless handle them successfully. WM. I. FLETCHER.

WATERHOUSE ON RICHARDSON.[1]

Capital from St. Leger, Soissons, France.

THE other biography I would allude to is that of a very different but also very remarkable man, Henry Hobson Richardson, of Boston, U. S. A., an Honorary Corresponding Member. Street was the king of draughtsmen, and drew every detail of his innumerable buildings himself. Richardson, on the other hand, was supposed never to have designed one of his later and more perfect buildings with his own hands; yet no architect ever put his name to structures which were more unmistakably his own creation. Street made the pointed arch the key-note of all his construction; Richardson saw the capabilities of the round arch, and his work in great measure was based upon Romanesque, though he treated it in his own original fashion. His works are so remarkable that I feel sure you will allow me to say a little more on a subject which has for me a singular fascination.

Richardson was a student of the École des Beaux Arts. He remained in Paris six years, working as a student and draughtsman, for he had to earn a living as well as to study, and lived practically two lives in one. In those days his great ambition was to go to Athens and Rome. He never, in fact, went to either, and, in spite of his training, never was architect less influenced by what these two centres of past art would have had to teach him. On his return to America in 1866, his first designs were in thirteenth-century Gothic, and in no way remarkable. But in 1870 he gained in competition the execution of Brattle Square Church in Boston, a building remarkable for its campanile with deep sculptured frieze, a tower so original as to be like nothing he could have seen or heard of elsewhere, though it has about it a certain Romanesque air. The neighboring Trinity Church followed soon after, with a central tower of excellent proportions, both in itself and as part of the composition of which it was, of course, the crowning feature. In construction it is no less bold than its detail is beautiful. Its weight of 8,500 tons is supported by four granite piers with a collective area of 100 square feet. His public libraries, of which he built several, have a family likeness in their plan and style, though each proclaims its distinctive character. His Pittsburgh Court-House, Field's Chicago Building and Cincinnati Chamber of Commerce are buildings of a monumental character, and give evidence of an original creative mind, free from prejudice and unfettered by precedent. Richardson's peculiarities may be seen in all. These peculiarities appear to be chiefly the discarding of the orders, the Romanesque feeling, admirable planning, appearance of strength and solidity, the value put upon mere wall-surface whenever attainable, the treatment of this surface by the varied coursing of the stonework, and the contrast between tooled and rough surfaces; the use of colored materials, especially of stone of different hues; battered bases, sparing use of string-courses, the introduction of deep voussoirs, the rounding of salient angles, and a leaning to circular forms on plan. In his later work his corbels are rounded and covered with delicate incised carving instead of mouldings, and his capitals are convex rather than concave. All these peculiarities appear to be based on sound judgment, and to be excellent in every way. On the other hand, if criticism were in such a case allowable, there seems, to my eye, almost an affectation in the shortness of

[1] From the opening address of the President of the Royal Institute of British Architects, Mr. Alfred Waterhouse.

some of his columns, and want of height in many of his circular archways. There is something ungainly in the upper part of transomed windows being made wider than they are high. It is also to be regretted that in many of his buildings the ridge and hip tiles and gable finials appear to be so heavy as to dwarf the general effect. In 1882 Richardson visited for the first time Southern France, Northern Italy and Northern Spain, and only then saw the best specimens of architecture from which he drew his inspiration. The effect of this tour, though he allowed himself no time for sketching, is visible in the works he executed in the short time afterwards left him. His becoming so devoted to, and so skilful an originator in, a style the best examples of which he had not seen, is in itself extraordinary, unless, indeed, a Romanesque wave had affected the American architectural mind before his advent. He seems to have created a new-born interest in architecture in America, perhaps by doing exactly what he thought best suited to the expression of his buildings, without going out of his way to look for precedents. In consequence, his work is never commonplace. He has left behind him a school of young Americans who appear to be following his steps in developing the capabilities of Romanesque art — an art which, we must bear in mind, did not die of inherent weakness, but was extinguished before its time in the twelfth century by the difficulties of vaulting oblong spaces and the consequent introduction of the pointed arch. I have, perhaps, said enough to show that Richardson's "*Life*," by Mrs. Van Rensselear, illustrated by photographs of his works, is worthy of earnest study.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF J. P. KERNOCHAN, ESQ., NEWPORT, R. I. MR. J. D. JOHNSTON, ARCHITECT, NEWPORT, R. I.

[Gelatine print, issued only with the Imperial Edition.]

CENTRAL SCHOOL-HOUSE, ERIE, PA. MESSRS. D. K. DEAN & SON, ARCHITECTS, ERIE, PA.

THIS building is 270′ long and 136′ wide in extreme dimensions, contains 24 school-rooms of an average size of 24′ x 38′, two rooms of 25′ x 100′, four rooms 24′ x 24′, all of which are supplied with cloak-closets provided with outside light. The central part of third story contains a hall 80′ x 90′, with stage, scenery, and four dressing-rooms, each 12′ x 20′. The building is heated by the Rutan-Smead system, and the system of Smead dry-closets is used. The basement is entirely given up to the heating and ventilating apparatus and the dry-closet system. All the interior finish is quartered oak. The cost of the building, exclusive of all furniture or school apparatus, is $145,000.

HOUSE FOR A. B. GOODBAR, ESQ., MEMPHIS, TENN. MR. W. ALBERT SWASEY, ARCHITECT, ST. LOUIS, MO.

THE house is built of Stock brick with Kibbe brownstone trimmings, red slate roof, first story of hard woods, balance cyprus; has ten rooms with dance-hall in attic, cost $16,000.

SKETCH FOR A CITY HOUSE. MR. FRANK MILES DAY, ARCHITECT, PHILADELPHIA, PA.

STORE AND OFFICE-BUILDING ON SCHOOL ST., BOSTON, MASS. MR. W. M. BACON, ARCHITECT, BOSTON, MASS.

DESIGN FOR A TOWER. MR. J. R. RHIND, ARCHITECT, MONTREAL, CANADA.

PULPIT ALTERATIONS DESIGNED BY MESSRS. W. W. BOSWORTH AND A. H. EVERETT, BOSTON, MASS.

THE PRESENT ASPECT OF LAND-DRAINAGE.—I.

The Trinity.

TWENTY-FIVE years ago, land-drainage hardly had a recognized position in this country, except in connection with that much derided art called "Fancy Farming." Most of the farm-drainage was done with stones or with horse-shoe tiles, which can hardly be called tile-draining. There is no better evidence of the value and extent of the influence of agricultural books and papers, of Book Farming, than the degree to which they have made known and acceptable to the farming community the results of isolated examples of work done mainly at the East. At the time spoken of, draining-tiles were made in few places and at rather high prices. The cost of their transportation prevented their extensive use in the interior. It was at that time asserted that the great garden spot of the West, Illinois, was so blessed by nature that it had no need for underdraining, and the same opinion was held as to much of the rest of that section of the country. The case is now gravely changed.

There are in single counties, in Illinois, more works for the manufacture of draining-tiles than there were drained farms in the State twenty years ago. The total length of underdrains in that State is now over 700,000 miles.

Illinois is not exceptional. In the best agricultural regions of the whole country, especially east of the Mississippi River, the underdrainage of lands not naturally sufficiently dry for the best production is general. The methods adopted are, of course, in many cases, rather crude, but the general result has been to secure a marked increase of product, immunity from the effect of excessive wet and drought, and a great mitigation of the malarial conditions formerly prevalent. In these respects, we have but repeated the experience of England. Agricultural underdrainage is hardly to be regarded now as an element of professional engineering work.

Those who carry on the trade of tile-draining understand sufficiently well for practical purposes a tolerably good method for securing the end in view. The same may be said with regard to surface-drainage, which is much more effective than, in the days of my first advocacy of underdrainage, I was disposed to admit. The reasons why any drainage of agricultural lands is required are better understood now than they were then. Probably the great advantage derived from the prevention of a condition of saturation is that it favors the continued and effective action of those minute organisms in the soil on which fertility so largely depends. It was formerly supposed that the organic constituents of the soil and the applied manure, as well as the mineral constituents were brought into a condition fit for the use of plants by the mere chemical effect (oxidation) of air circulating among them. It has been demonstrated within the past ten years that the conversion of organic remains and organic manures into a condition available for the feeding of plants is the work of bacterial action. This work results in oxidation it is true, but the process is very different from that resulting from immediate chemical contact. That the development of the fertilizing qualities of the mineral constituents of the soil is also due to a corresponding action of living organisms has not been demonstrated, but the growth of rhizopods on the surface of minerals, and the consequent change of character of the inorganic structure itself and the cryptogamous vegetation peculiar to certain mineral solutions would indicate that such action is possible.

SURFACE-DRAINAGE.

While the effect of aeration in the subsoil increases porosity, and the withdrawal of the water-of-saturation from the lower strata of the soil is as important as it was originally supposed to be, there is no doubt that the most valuable effect is produced in those parts of the soil which are near the surface and are by underdrainage kept always in such condition that their living organisms do not have their activity suspended for long periods by a saturation that excludes atmospheric air. In many cases, this more important effect of draining the upper portions of the soil may be secured, in measurably useful degree, by surface-drainage, that is, by affording the surplus water an opportunity to flow freely away over the surface instead of lying to be slowly absorbed by the soil. As compared with its cost, much of the most useful effect will be produced by the use of catch drains to divert the flow of surface and spring water from higher lands and by such a regulation of the surface as will prevent water from standing in pockets or lying on level tracts after a storm has ceased.

The removal of water from the surface of level lands which are not underdrained is most economically effected by the opening of ditches for its removal. If the ditches are reasonably near together, a good result will be produced by giving them a water-level of from twelve to eighteen inches below the surface. They should be so arranged as to receive the water of the surface freely: to hold the water of a heavy storm at a level slightly below the surface of the ground, and to run down to the indicated level within twenty-four hours. Rolling lands, with swales and pockets in which water stands and accumulates, may be relieved often much more simply and economically by the running of single lines of depressed water-ways. These need not even be ditches, only continuous artifical depressions with broad banks, susceptible of cultivation and of machine-mowing and leading to a proper point of discharge. To provide such a means of drainage is easy and inexpensive if a proper point of outlet is at hand.

In many cases, and it is these that call for the intervention of the engineer, tracts sometimes of many thousands of acres lie too low or have too little inclination for the removal of rain-fall. These are sometimes actual swamps and sometimes lands lying so near the dead water-level as to be too much saturated for the production even of the best grasses. In these cases large and deep district drains or canals are required. Many of the States have drainage laws authorizing the execution of this work under the direction of State or County Commissioners at the charge of all who are to be benefited. These draining canals are sometimes of such width and depth as to be excavated by floating dredges working in from the body of water into which they are ultimately to discharge, and carrying a depth of water sufficient to float the apparatus quite to their upper ends, miles away. In this manner, districts subject to constant saturation are enabled to obtain the full benefit of their slight grades and to

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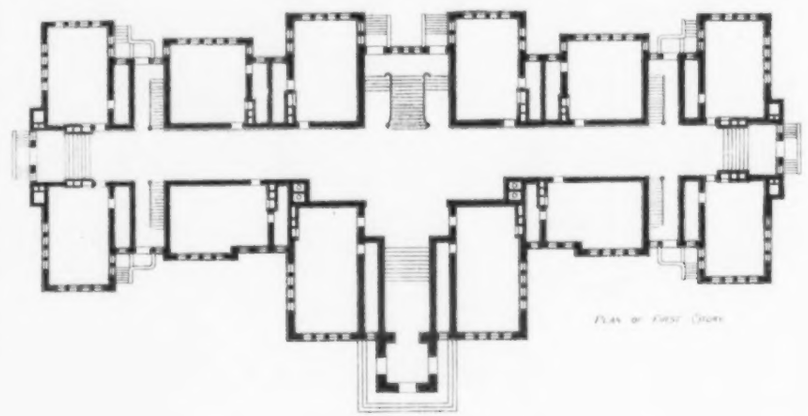
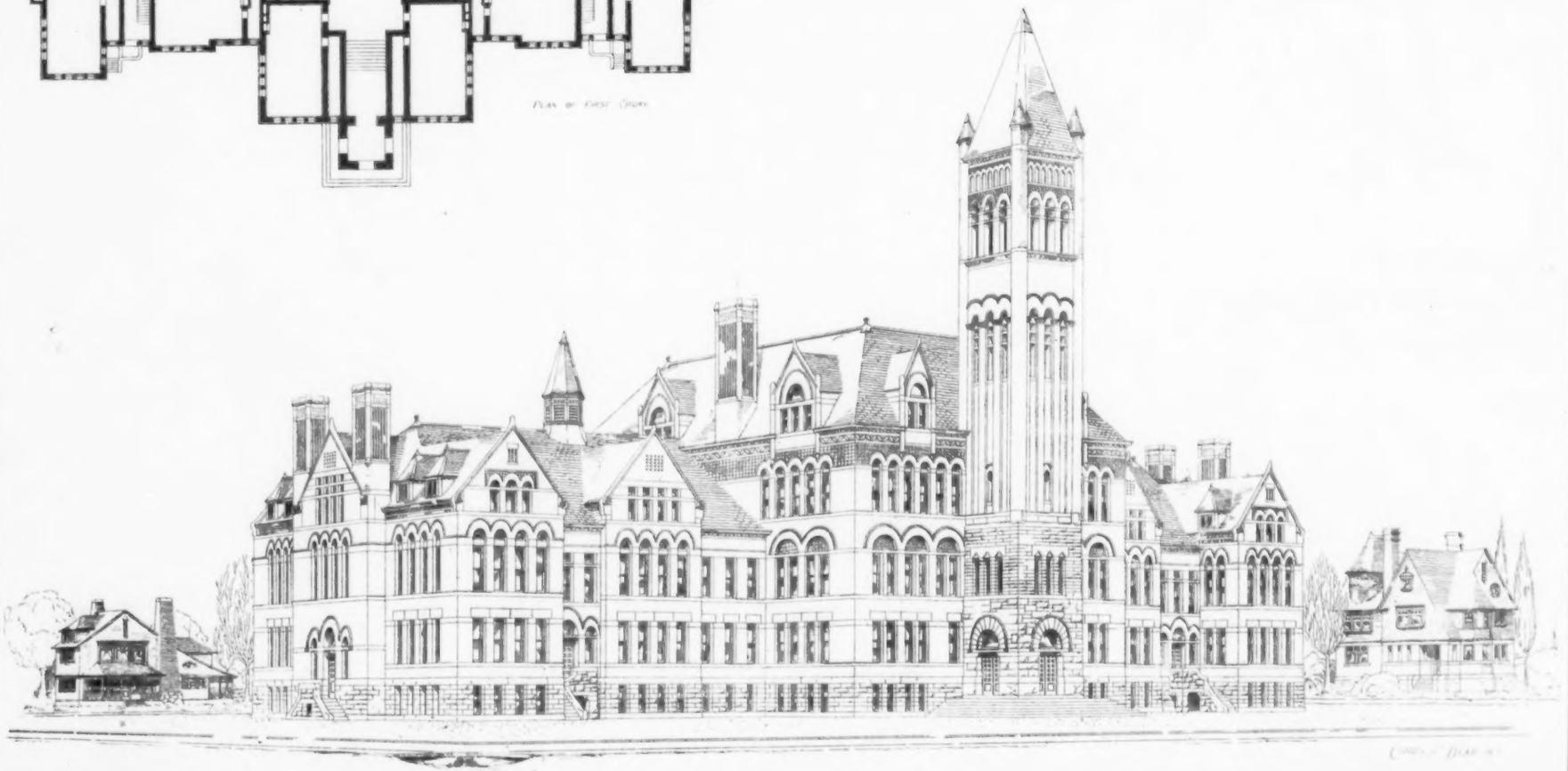


CENTRAL SCHOOL
ERIE PENNA
D.K.DEAN & SON ARCHTS
ERIE PENNA



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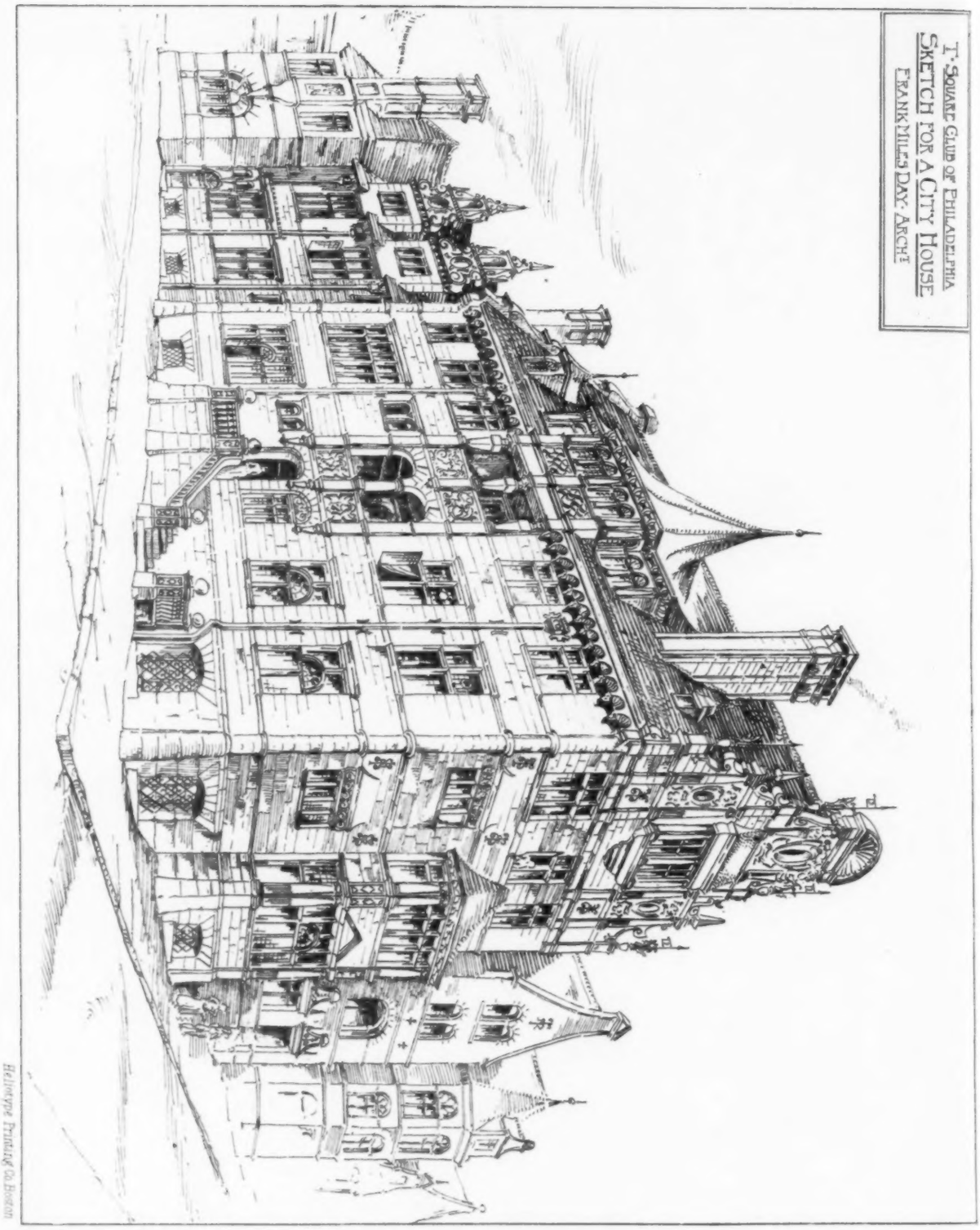

T. SQUARE CLUB OF PHILADELPHIA
SKETCH FOR A CITY HOUSE
FRANK MILES DAY, ARCH.T

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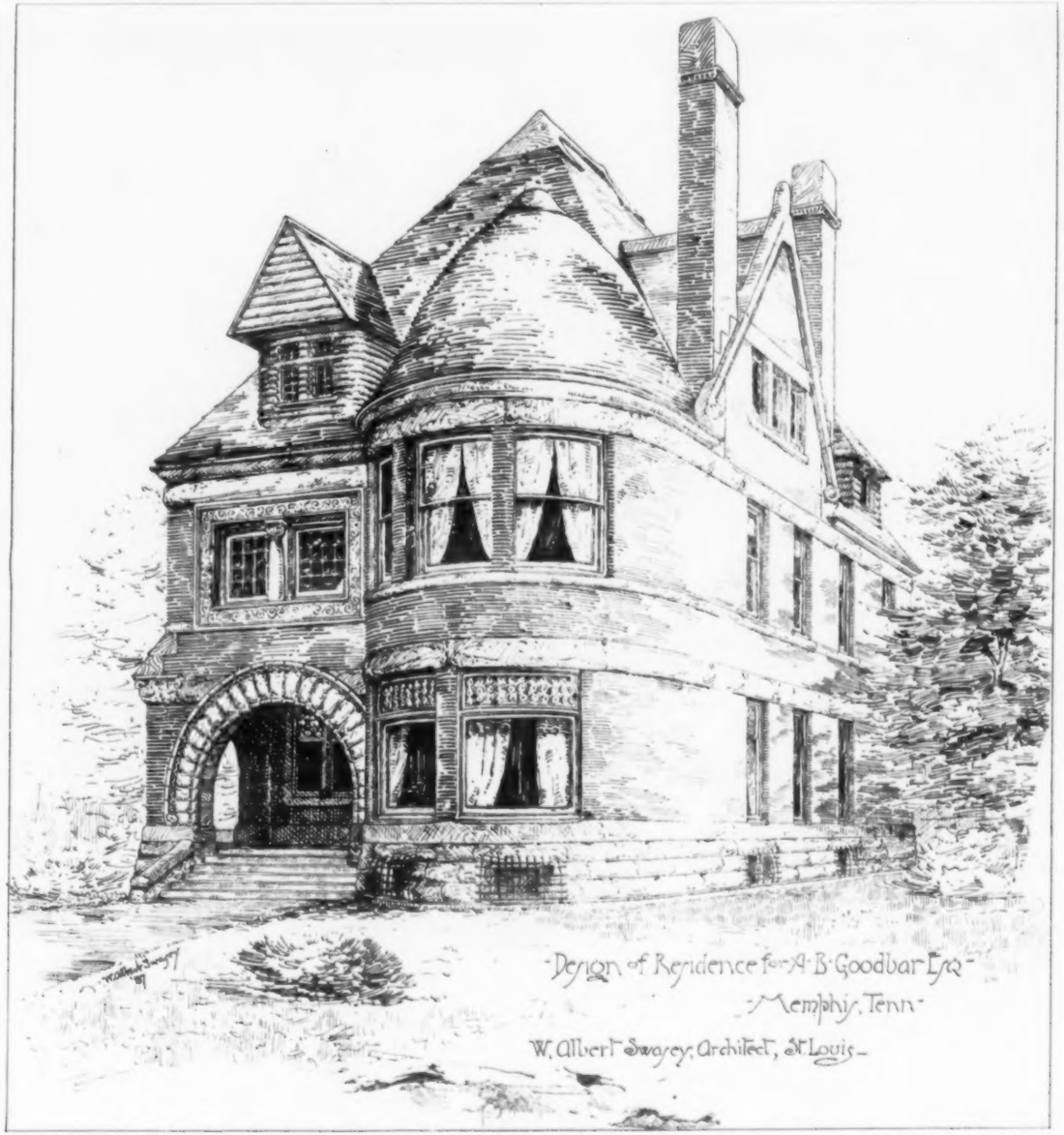
Top Finish
of a Tower
James R. Rhind. Arch't
Montreal.
June 1888.



Design of Residence for A. B. Goodbar Esq.
Memphis, Tenn.
W. Albert Swasey, Architect, St. Louis.

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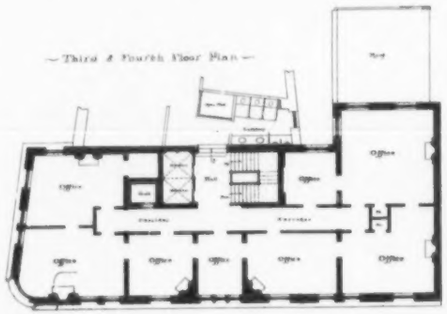
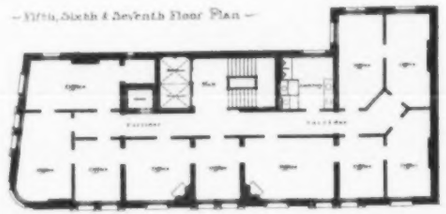
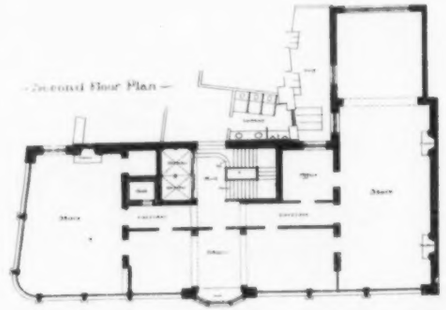
THE NILES BLOCK School St. Boston. Mass. Willard M. Bacon, Archt. E.L.B. del.

E. Elton Bacon del.







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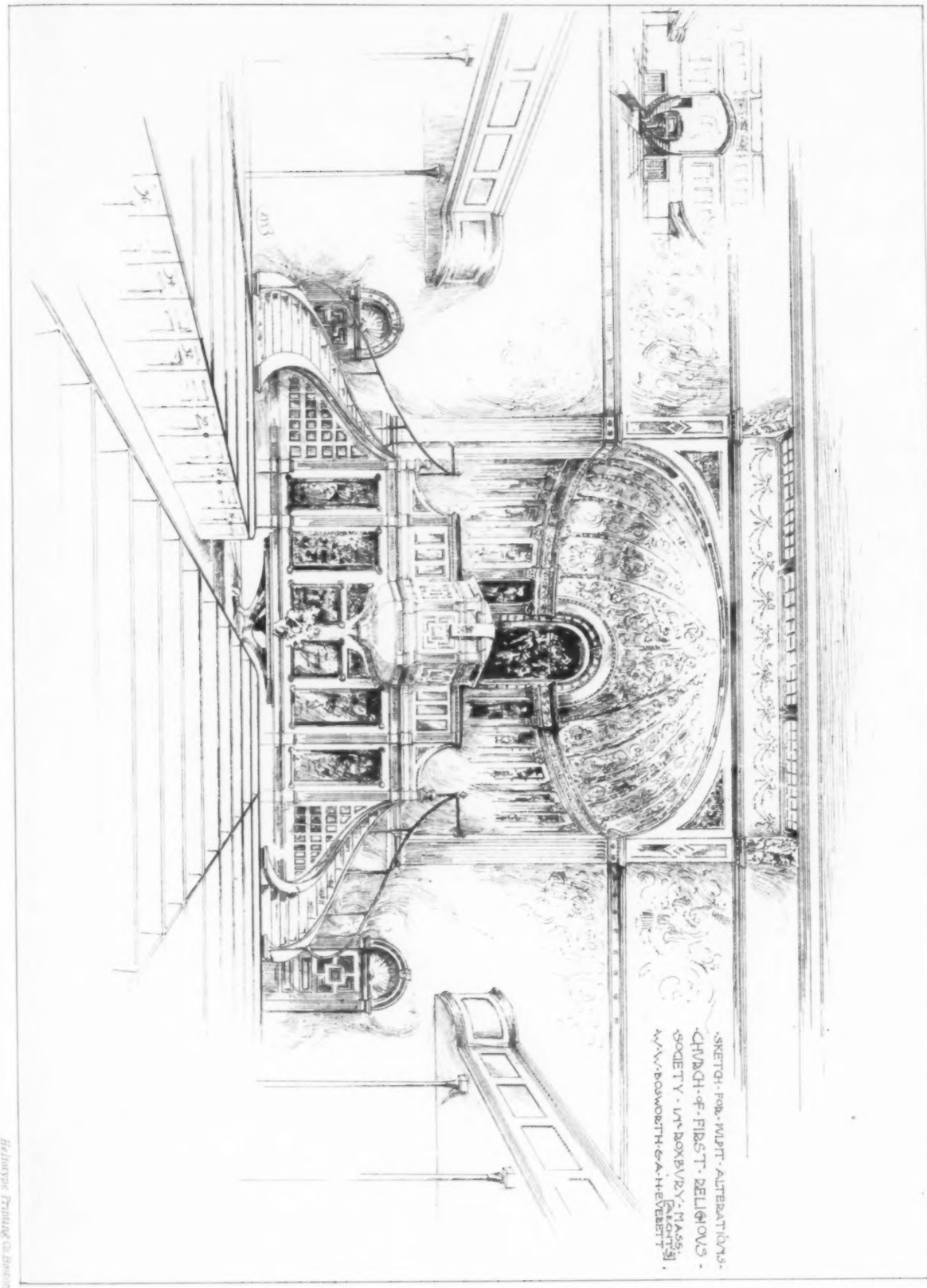

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deliver their drainage outflow nearly at the level of the water into which their main drainage canal delivers. Lateral branches of the canal, extending on either side carry an effective drainage level throughout all parts of the district.

In other cases, lands of great area, requiring drainage, are dependent for their outflow on tortuous and sluggish creeks or rivers which are inadequate for the prompt removal even of the water of ordinary rains. The difficulty is often aggravated by the existence of mill-dams holding prescriptive rights along the lower reaches of the stream. In such cases, the mill rights have to be extinguished, and the water-course straightened and cleared, if not enlarged.

Again, wide areas of riparian marsh are rendered useless by their low level as compared with the tidal waters with which they are bordered. These are to be drained by excluding high floods, cutting off upland waters, and discharging on the fall of the tide. In all of these cases, the assistance of the engineer is in request and he will often find his knowledge, ingenuity and tact severely tried by an attempt to meet the difficulty effectively and economically. It is a simple matter to make a canal large enough, or dikes high enough, or to give ample water-way to obstructed water-courses, but the expense of all of these operations, and the charge for maintenance fall upon a class of men of little capital and of limited means for bearing the cost of the work. It becomes necessary, therefore, not only to make the ditch large enough but to make it not too large; to make dikes effective but neither too high nor too broad, and to limit the improvement of the natural water-courses to what is really necessary. A just balance must be struck between immediate effective drainage of the whole district, and such inadequate works as would drain the land too slowly for considerable practical benefit. It would, of course, be an advantage to place every acre of the whole district in such condition that it would be dry and firm within a few hours after the heaviest rain, but it would often cost five times as much to do this as to make such an outlet as will drain distant portions sufficiently for the production of good and wholesome grass, though too wet for reliable use for plough crops. The owner can better afford to take his chances of securing a fair crop of corn, with a certainty of good grass crops, than he can afford to pay the extra tax required to put his land always in condition for perfect tilth.

In the present condition of the agricultural district of the United States, there can be no doubt that a better return will be ensured for the amount of money laid out in the reasonably effective surface-drainage of lands now saturated, or, at times approaching a swampy condition, than an equal amount expended in the underdrainage of lands lying sufficiently high to make underdrainage profitable. In saying this, I would by no means be taken to imply that underdrainage is not largely profitable, and is not to be recommended in all cases where it is possible; only that while underdrainage increases and insures the product of lands now largely tillable, the surface-drainage contemplated gives value and product to lands now worthless, in the sense of not producing a sufficient return to pay the cost of cultivation.

UNDERDRAINAGE.

If a rule could be adopted which would cover the varied circumstances of different soils, it would be somewhat as follows: All lands, of whatever texture or kind, in which *the spaces between the particles of soil* are filled with water (whether from rain or from springs) within less than four feet of the surface of the ground, except during and *immediately* after heavy rains, require draining.

Of course, the particles of the soil cannot be made dry, nor should they be; but, although they should be moist themselves, they should be surrounded with air, not with water. To illustrate this: Suppose that water be poured into a barrel filled with chips of wood until it runs over at the top. The spaces between the chips will be filled with water, and the chips themselves will absorb enough to become thoroughly wet; this represents the worst condition of a wet soil. If an opening be made at the bottom of the barrel, the water which fills the spaces between the chips will be drawn off, and its place will be taken by air, while the chips themselves will remain wet with the water which they hold by absorption. A drain at the bottom of a wet field, in like manner, draws away the water from the free spaces between its particles and its place is taken by air, while the particles hold, by attraction, the moisture necessary to a healthy condition of the soil.

There are vast areas of land in this country which do not need draining. The whole range of sands, gravels, light-loams and moulds allow water to pass freely through them, and are sufficiently drained by nature, provided, they are as open at the bottom as throughout the mass. A sieve filled with gravel will drain perfectly; a basin filled with the same gravel will not drain at all. More than this, a sieve filled with the stiffest clay, if not puddled, will drain completely, and so will heavy clay soils on porous and well-drained subsoils. Money expended in draining such lands as do not require the operation is, of course, wasted; and, when there is doubt as to the requirement, sufficient tests should be made before the outlay for so costly a work is encountered.

There is, on the other hand, much land, which only by thorough draining can be rendered profitable for cultivation, or healthful for residence, and very much more, described as "ordinarily dry land," which draining would greatly improve in both productive value and salubrity.

The sources of the water in the soil are various. Either it falls directly upon the land as rain; rises into it from underlying springs; or reaches it through, or over, adjacent land.

The *rain-water* belongs to the field on which it falls, and it would be an advantage if it could all be made to pass down through the first three or four feet of the soil, and be removed from below. Every drop of it is freighted with fertilizing matters washed out from the air, and in its descent through the ground, these are given up for the use of plants; and it performs other important work among the vegetable and mineral parts of the soil.

The *spring-water* does not belong to the field — not a drop of it — and it ought not to be allowed to show itself within the reach of the roots of ordinary plants. It has fallen on other land, and, presumably, has there done its appointed work, and ought not to be allowed to convert our soil into a mere outlet passage for its removal.

The *ooze-water* — that which soaks out from adjoining land — is subject to all the objections which hold against spring-water, and should be rigidly excluded.

But the *surface-water*, which comes during rains over the surface of higher ground in the vicinity, should be allowed every opportunity, which is consistent with good husbandry, to work its slow course over our soil — not to run in such streams as will cut away the surface, nor in such quantities as to make the ground inconveniently wet, but to spread itself in beneficent irrigation, and to deposit the fertilizing matters which it contains, then to descend through a well-drained subsoil, to a free outlet.

From whatever source the water comes, it cannot remain stagnant in any soil without permanent injury to its fertility.

The only sort of drain to which reference is here made is that which consists of a conduit of burned clay (tile) placed at a considerable depth in the subsoil, and enclosed in a compacted bed of the stiffest earth which can conveniently be found.

A well-laid tile-drain has the following essential characteristics: 1. It has a free outlet for the discharge of all water which may run through it. 2. It has openings, at its joints, sufficient for the admission of all the water which may arise to the level of its floor. 3. Its floor is laid on a well-regulated line of descent, so that its current may maintain a flow of uniform, or, at least, never decreasing rapidity, throughout its entire length.

Land which requires draining, is that which, at some time during the year (either from an accumulation of the rains which fall upon it, from the lateral flow or soakage from adjoining land, from springs which open within it, or, from a combination of two or all of these sources) becomes filled with water that does not readily find a natural outlet, but remains until removed by evaporation.

If such land is properly furnished with tile-drains (having a clear and sufficient outfall, offering sufficient means of entrance to the water which reaches them, and carrying it, by a uniform or increasing descent, to the outlet) its water will be removed to nearly, or quite, the level of the floor of the drains, and its water-table will be at the distance of some feet from the surface, leaving the spaces between the particles of all the soil above it filled with air instead of water. The water below the drains stand at a level, like any other water that is dammed up. Rain-water falling on the soil will descend by its own weight to this level, and the water will rise into the drains, as it would flow over a dam, until the proper level is again attained. Spring-water entering from below, and water oozing from the adjoining land, will be removed in like manner.

The water which reaches the soil may be considered under two heads:

1. That which reaches its surface, whether directly by rain, or by the surface-flow of the adjoining land.

2. That which reaches below the surface, by springs and by soakage from the lower portions of adjoining land.

G. E. WARING, JR.

INJURY TO COAL BY SPONTANEOUS IGNITION.

A Peruvian Wooden Seat.

THE questions pertaining to spontaneous ignition of coal have received the most extensive treatment from the various boards of investigation which have considered the subject. A recent American fire due to this cause brings to light a new feature in regard to the subject. The facts in the case were that about five thousand tons of semi-bituminous coal, which were kept in two brick houses, ignited spontaneously in the early autumn, about the middle of September, the fire being discovered in the two houses within a couple of days of each other. From the indications on the top of

the pile, furnished by the smoke curling in various places, it was apparent that the fire had extended throughout the whole mass; and the deposition of sulphur on the surface of the pile, as it condensed from the volatile matter rising from the interior of the pile, presented the appearance of a yellow dew. Of the injury to the building by the heating of heavy brick walls to dull redness, and the burning of all timber in contact with the coal, we have nothing to do; but the method adopted by the underwriters in the settlement of the loss was certainly outside of the usual course taken in such matters. This is, we understand, either to settle the loss on the basis of a lump sum, which one party tries to increase and the other to diminish, until in the spirit of exhaustion rather than compromise, they settle on an average; and the other plan is to pay for the coal, and then sell it to small consumers by forcing the consumption by means of ruinously low prices, which do not reward the seller, and also interfere injuriously with the retail business in the vicinity. The method used in this instance was to take a sample of the coal from a portion which was uninjured, and subject it to chemical analysis, which gave:

Carbon	76.50
Hydrogen	3.98
Mineral matter	12.13
Sulphur combined with iron	.79
Sulphur inorganic compounds	.69

The calorific value of a pound of this coal as computed from the above, equals 13,594 thermal units. Other samples were obtained from the average of the pile when about half of the coal had been removed to a yard, leaving an oblique plane, which cut through approximately the centre of the mass. These samples were collected from regular points over the slope, and taken to a clean pavement where they were crushed and thoroughly mixed over to obtain a smaller sample for the purpose of analysis, which should represent the average composition of the coal throughout the whole slope. This analysis gave:

Carbon	74.13
Hydrogen	3.95
Mineral matter	13.18

The calorific value of this sample of coal amounted to 13,230 thermal units, or 2.68 per cent as the depreciation of the value of the coal by heating, and it was upon this basis that the loss upon the coal itself was reached. A sample of partially coked coal, which represented an average sample of the coal actually injured by heat so as to make a noticeable change in its appearance, showed upon analysis:

Carbon	65.77
Hydrogen	1.56
Mineral matter	26.13
Sulphur total	.82

The calorific value of the coal amounted to 10,409 thermal units, or 22.7 per cent less than that of the uninjured coal. The cause of the heating was undoubtedly due to the presence of sulphur in its combination with iron, forming iron pyrites. A defect in the consideration of the liability of various forms of bituminous coal to spontaneous ignition, has been due to considering the total amount of sulphur as the measure of hazard, an assumption which contains two errors sufficient in themselves to render that process of forming an opinion entirely unreliable, because the sulphur liable to produce heat by chemical changes under normal conditions is the sulphur in combination with the iron, forming iron pyrites. Th's disintegrates under the most ordinary conditions, while the sulphur in organic compounds is not liable to such changes. Secondly, a measure of this liability is not shown by an ordinary chemical analysis, which represents a sample selected by averaging up a large number of specimens, but the danger is due to the greatest concentration of iron pyrites, and not to its average presence in the whole mass. — *Engineering.*

A GOVERNMENT TESTING-STATION.

THE following memorial was submitted to the Washington Chapter by Mr. Cluss, and it was unanimously determined that it be incorporated in our annual report, with the request that the Board of Trustees, or the Convention, take the necessary preliminary steps to bring the matter before Congress:

MEMORIAL ON THE ESTABLISHMENT OF A CENTRAL TESTING-STATION FOR BUILDING MATERIALS IN THE UNITED STATES.

The building interests of the country have assumed such vast proportions and important bearings on life, limb and health of the people, as to demand a commensurate organized recognition from the Government, such as has been awarded in the past to commerce, shipping, manufactures, agriculture, mining, education, transportation, and, sporadically, to specialties, such as ores, metals, victuals, drugs, etc.

Consistent steps should be taken without delay towards relieving the representatives of the building interests from an isolated position and unsatisfactory dependence upon partly antiquated hand-books, or incomplete new publications prepared by private enterprise, with diligence and ability, but, without adequate financial and technical resources and scientific support for keeping abreast the exacting demands of a progressive age, in the midst of a prosperity in building enterprises and engineering feats, without any precedent in the world's history.

While fully appreciating the valuable work of the Franklin Institute in Philadelphia, of Prof. Thurston in Hoboken, the wholesale crushing of specimens of cements and stones, with the 200-ton Government testing-machine at Watertown Arsenal, and valuable tests made by officers of the Engineer Corps, United States Army, it cannot be denied that much valuable information is scattered so as to be inaccessible, in many cases forgotten, wasted or lost, and, on the other hand, that the ground is, in various directions, not covered at all.

The same difficulties, though in a minor degree, have been encountered in the older, long-explored, principal countries of Europe since the present wonderful activity in works of architecture and engineering has set in.

The solution has been found in the establishment of special institutions — testing-stations for building materials, which have proved to be safe regulators for the restless work.

For safe building, the statical coëfficients of strength and elasticity of the materials must be ascertained and controlled, whenever a case of importance occurs. The hardness and durability of building stones from newly-opened quarries, or new strata of old quarries, must be tested and steadily observed. The construction, into which different materials are combined, must be considered in connection with the magnitude and action of the opposed forces, and the best conditions for using the obtained factors must be determined.

The practising architects cannot attempt to perform such labor in order to obtain needed information. The quarry and other materialmen need likewise facilities for obtaining reliable tests of newly-opened deposits of raw materials, as guides for the best methods of producing and manufacturing them. All these data, experimentally determined, form the basis of the judicious use of the building materials.

In our case, a central head-station ought to be founded by the Federal Government as a nucleus for harmonious methods and guidance of local institutions to be maintained by States, or large central cities, East, West, North and South. This central station, too, is under the lead of professional specialists of highest standing, so as to insure at the outstart, the confidence of authorities and citizens in the straightforwardness of the tests and experiments. Liberally fitted out with apparatus and laboratory accommodations, the technical expert, physicist and chemist, are to promote each other's ends by mutual support, and, at stated intervals, by consultations with practitioners, called in for the purpose.

Besides attending to the tasks delineated above, the officials of the stations are generally to determine, according to a moderate scale of rates, the quality of materials for interested parties, *from their uniform points of view*, and, in case of litigations, may be called to give opinions or make decisions of weight. To protect the interest of inventors or other private parties, the officials of the station are to be sworn to keep such orders private, unless the interested parties give their assent to publicity, when they may be published in the annual reports of the station, if of sufficient public interest.

Strength and properties of quarried stones, flagging, burned and unburned artificial stones, cements, limes, plaster-of-Paris, builders' felts, asbestos fabrics and other fireproof materials, pipes, wire-ropes for elevators, wrought and cast iron columns and beams, corrugated metal, strength of brickwork, masonry and joints, stability of brick and stone piers, are among the objects within the range of the station. Tests on the lasting qualities of paper and ink for public documents and similar work may come in as incidentals.

Based on the initiative of the *Institut Statistique* of France, improved central stations with branches in large cities, are in successful operation in Switzerland, Germany, Austria, Russia, etc. Prof. Tetmeyer in Zurich, Dr. Boehme and Martens in Berlin, Prof. Bauschinger in Munich, and others here have already made their mark in developing the resources of their countries, and in advancing sound knowledge of universal importance. It is for the proposed station to scan the vast field, add to the stock by original experiments with the resources available in this country, and bring and keep results in the best shape for use in practice.

It is essential to arrive at recognized uniform classifications, under which systematical gradations of the different groups of building material are to be arranged according to their most important properties, and to establish binding rules for tests of quality and precise conditions for the delivery of materials.

The testing-station, in Berlin, is equipped for tests of material in hot, cold, dry, wet or changeable state. It owns hydraulic presses with varied capacities up to 320,000 pounds, and facilities for inserting test pieces from the minutest sizes to large sized columns of brickwork, masonry, etc.

There are accommodations for determining specific gravity, porosity and hygroscopicity.

Machines based on combined leverage system for tests of tensile, compressive, transverse, sheering and torsional strength.

Machines for testing materials under often repeated strains.

Atwood's machines for testing resistance to live forces.

Presses for testing pipes exposed to internal pressure up to 500 pounds per square inch.

Machines for determining the abrasion of paving materials by wear.

Apparatus for microscopic tests and photography.

Apparatus for analyses of organic and inorganic substances, fuels, oils, etc.

The European institutions are due to the initiative of the National Societies of Architects and Engineers. It is suggested that the American Institute of Architects ask the coöperation of the American Society of Civil Engineers, and, perhaps, also, the Society of Mechanical Engineers, in memorializing and prompting Congress on this important subject.

Respectfully submitted,

GLENN BROWN, *Secretary* W. C. A. I. A.

BOOKS AND PAPERS

MR. GARDNER'S ideas on buildings of any sort are always those of a well-read and experienced architect, applied with much ingenuity and success to the problems he sets himself, and, above all, expressed with a simplicity and clearness which seem peculiarly adapted to carry conviction to the layman's mind. For this reason, principally, all his books have done the profession good service as tracts, opening what we may call the heathen intelligence to the light of good taste, adaptation to circumstances, and solid construction which so many of us, less gifted than Mr. Gardner, have hitherto preached in vain. It is possible that his book[1] on school buildings may prove less popular than one on dwelling-houses, since every one takes an interest in his home, while most people know nothing and care less, about the structures in which their children's souls and bodies are being trained, but that does not make the subject less important, and if Mr. Gardner's earnest and attractive writing shall serve to call public attention in some degree to it, he will have deserved well of his fellow-citizens. We need hardly call attention to the details of the advice which he gives his readers, as nearly all the points mentioned are familiar to architects who have made any study of school buildings, but something should certainly be said in regard to the pretty sketches which form a large part of the illustrations.

GRIMSHAW'S "*Pump Catechism*"[2] is a handy little volume of 230 pages, intended not so much for specialists as for those who have occasion to use technical knowledge only at rare intervals, and feel the necessity for a ready-reference book on the subject. It is a good work for that ubiquitous character found around all large buildings and dubbed "the engineer," for lack of a better name, who is supposed to know about everything that has to do with machinery in any form. It would also be of service to employers who know nothing themselves, but like to ask posing questions of their employés, and need some good authority to back them up in case the employé should turn about and pose the questioner. The information is imparted entirely in the shape of questions and answers relating to nearly all the pumps in the market, their construction, how they are set up, repaired, taken apart, etc. There are also points in regard to the general subject, the kinds of pumps, valves, principles of atmospheric action, calculations, and kindred topics. The answers are concise and complete as far as they go, and are supplemented by quite full illustrations and a cross index. The value of the work as a scientific treatise is quite small, and it would probably be of more interest to the so-called "practical mechanic" — who usually possesses a minimum of real knowledge — than to any one else; still, for its purpose, the book is well worth all it costs.

DR. LÜBKE, in his latest undertaking,[3] continues in a field that has been much worked, especially in recent years and in Germany. Contemporaneously with his "*History of German Art*," there are appearing under the same title carefully prepared publications by Dr. Janiteschk and Professor Knackfuss, the latter's richer in illustrations than Lübke's work, and affording a practical aid to rapid reference by the employment of smaller print for detailed description than is used in the text. The name of Dr. Lübke, however, assures a ready welcome for his history, and it is not surprising to learn that the subscriptions (all works on art in Germany are published by subscription) have reached already in a few weeks a number that is highly gratifying to author and publishers.

Dr. Lübke's reputation has risen with a steady and equable growth, and has spread into countries and among classes where the names of Woltmann and Schnaase are known only to a few. The chief of German art critics passed through a long time of obscurity and want of favor. Kugler is thought to have enjoyed an enviable success in his time. Yet Kugler's "*History of Painting*," after going ten years before a second edition was called for, met with failure in the third, published in 1867, thirty years after its first appearance; and his "*History of Art*," in which the attempt was made for the first time to represent the development of art in connection with the great epochs of political history, did not become popular until three decades after its publication.

Dr. Lübke's books have met with an exceptional fate. His "*History of Art*" went through seven editions in sixteen years, and his "*History of Architecture*" five in twenty years.

The "*History of German Renaissance*," less known in America and England than the last mentioned, and its companion, the "*History of Sculpture*," found a public as soon as they appeared; and later, when Germany revived her industries on recovering from the exertions and the ruinous results of financial speculations that followed the wars with Austria and France, the "*German Renaissance*" was even made a text-book, and the authority for the movement that swept over the country and incited the present reigning taste for *Alt-deutsch:* all without detriment to his reputation in the regard of scholars, the proverbial good luck of Lübke hindering the many exaggerated and absurd outgrowths of the movement from being laid at his door.

Dr. Lübke's enthusiasm for things German, while unremitting, is tempered. Nor has he any impassioned votaries. Rather, he is left apart in the contention of champions over the historians of their special affections, as claiming absolute devotion from few or none, but having his compensation in the respect of all. Not striving for the first place at the head of learned archeologists, he takes a second by general consent. Those who would rank him on a level with the first two or three living German historians and critics of art are hardly fewer than those who would refuse to place him next after them. The appreciation he meets with is of a popular kind, while the extent of it is declared by the successive editions his books all go through.

It is Dr. Lübke's merit, while not gifted with poetic talent, to have cultivated a clear style. The objects of his dissertations are works of creative genius, so that, with this medium of expression, they furnish often of themselves the warmth and glow that inheres in art, and which is justifiably looked for in descriptions of works of art. He is far from conveying the sense of unabating, joyous research and appreciation that forms the charm of Winklemann; as far, perhaps, is he, on the other hand, from the dry antiquarian habits of mind in which an object loses its attraction as soon as it has been capably dated and labelled. Lübke's research is rather that of the modern author; it is undertaken with a practical aim, and, when this has been conscientiously fulfilled, he is done, not with the thing, but with the relation in which he had for the time being set it. Unlike the mere antiquary, he is able to return to it again with fresh interest. He changes his points of view, and a new perspective incites him to further attentive investigation. The results of his study he uses to exhaustion; but he has the journalistic economy, so to speak, and does not give too many of them at one time. His popularity has no other secret than this practical division of his material. Each of his histories is divided into a few parts only, and the examples and descriptions that are furnished, although abundant, are never excessive and drawn out to a tedious length. Whatever knowledge remains over from one work is embodied in another, local and antiquarian details being often given to the world of specialists in the form of monographs. Dr. Lübke, in brief, is content to use his learning, rather than bent upon displaying it. Readers of his books feel that his last word is determined by the measure of his sense of propriety, not by his conception of their superficiality nor by his own ability to give.

These reflections occur in respect of Dr. Lübke. A review of the "*History of Germanic Art*" recalls them the more readily, perhaps, because the virtue of economizing material is stretched in this, his latest work, to a point beyond that of any in his previous productions, and beyond which no historian can go and retain anything like fulness of composition with clear relief of parts.

The subject of jewels of gold, silver, bronze and iron, found in graves, and that of miniature painting, the chief characteristic of which is variation of geometrical designs, together with the flat surfaces of the metals — "a peculiarity to be traced back to the habit of carving *in wood*" — may be illustrated by a restricted series of examples, which, in their turn, are concisely described. But so important a work of early architecture as the monument of Theodoric at Ravenna, with its flat stone roof, composed of a giant monolith of Istrian limestone eight thousand centners in weight, merits, we think, a fuller exposition than that it was a "thought originating in the Germanic times of yore." This is especially true when, as is the case, the only mention previously made of the "Germanic times of yore" in respect of architecture is that the houses of the early Teutons were *of wood*, and not of stone. Indeed, Dr. Lübke here is betrayed by his conciseness into obscureness, and even into contradiction; for Germans, he tells us on an earlier page, were natural carpenters, and not masons, in support of which, among other facts, he mentions the philological proof of the words that are connected with carpentry being Germanic by origin; whereas such as describe the material and labor of masonry — *Thor, Dach, Mauer, Kalk,*

[1] "*Town and Country School Buildings.*" A collection of plans and designs for schools of various sizes, graded and ungraded, etc. By E. C. Gardner. New York and Chicago: E. L. Kellogg & Co., 1888.

[2] "*The Pump Catechism*," by Robert Grimshaw, M. E. New York: Practical Publishing Co., 5 Dey St.

[3] "*Geschichte der Deutschen Kunst*," von Wm. Lübke. Stuttgart: Ebner und Seubert, 1888.

Cement, Strasse, Pflaster — are derived from the Latin tongue. The illimitable forest offered abundant raw material, and "our ancestors may have felt doubly comfortable in a shelter won from the familiar wood."

As there is no mention made of earlier examples of stone roofing to support the sudden assertion that the monolithic covering of Theodoric's tomb was a Germanic idea, so Dr. Lübke fails to refer by way of chronological illustration to early examples elsewhere. The date of Theodoric's monument falls within the first two decades of the sixth century. If a roof of stone belonged to the "arrangement" of German architecture at that period, it would be of interest to hear how Dr. Lübke would explain the fact that in England the introduction of stone for roofing occurred so late; for, if we except the Druidic remains, the first appearance of stone roofs dates in the twelfth century, when Alexander caused Lincoln Cathedral to be restored with such subtile skill, as John of Huntingdon declares, that it seemed to be fairer than when it came from the builders' hands, and which, Giraldus expressly informs us, was "the first to receive the firm and noble covering of stone vaulting."

We cannot have mistaken Dr. Lübke's word *anordnung* as applying to the roofing, whereas it refers to the general plan of the monument. The plan, he says, is essentially Roman in "*Anlage und Construktion.*" The ground-floor forms a cross inside, but shows without a decagon. The wall is composed of immense blocks of limestone, the plain and solid construction of which is enlivened by round-arched niches of considerable depth. A single door opens into its interior. The upper story is round, and is smaller in circumference than the lower portion. Originally, it was girt by an arcade, the joints of whose arches are still visible, and gave, no doubt, to the dignified and massive pile the look of life and the touch of grace which the present building is wanting in.

The cornice of the roof is a bone of contention between our author and the learned director of the royal archives in Berlin, Dr. Dohme. The latter gives it over with the rest to Roman art, and calls the ornamentation "misunderstood Classic details." Besides the familiar head and ovolo patterns that occur, there appears a form as the principal decoration of the upper portion of the cornice, that is described by Dohme as the pincers pattern. Dr. Lübke sees in the form an example in sculpture of the play and combination of lines that is characteristic of Germanic jewelry and miniature ornamentation, and claims the pattern, accordingly, for German art. Two flights of stone steps outside the monument lead in a broken range from the ground to the arcade above, where they meet in front of a doorway in the circular upper story, directly above the portal in the massive angular wall of the basement below. Although restored in the past century, the structure of this stairway is antique in the main.

The sarcophagus of King Theodoric, which, according to a tradition, is the same that is now seen built into the face of the palace wall at Ravenna, is supposed to have originally occupied a place in the middle of the ground-floor. An opening in the centre of the vault formed a connection with the upper portion, so that we have in the monument "*the first example of the double-chapels of the Middle Ages.*" Small slits in the masonry allow of the faint passage of light into the tomb, while miniature arched windows, single, and separated by spaces not at all too great, illuminated the interior of the upper or chapel floor. The latter was provided at first with light from above, according to one old account, but the opening was covered later by a cenotaph of slate under a baldachino that was exalted on pillars.

The only existing building in Germany of the same epoch as the monument in Ravenna is the Cathedral of Triers.

The illustrations of this, as of the tomb, are good; whereas those of the monuments of Charlemagne's time, such as the Cathedral of Aix-la-Chapelle, seem to be from old plates that are somewhat worn.

Countess v. Krockow.

COMMUNICATIONS

TWENTY-EIGHT STORY BUILDINGS.

Minneapolis, Minn., 1888.

To the Editors of the American Architect:—

Dear Sirs, — In your last issue, in an editorial which has for its text the contemplated twenty-eight-story building in Minneapolis, you speak at more or less length of the difficulties arising from unequal settlements, etc., evidently assuming that the structure is one of brick, stone and mortar, whereas this is exactly what it is not.

As has been before described, it is a braced and riveted rolled-steel frame not unlike four bridge trusses stood on end and fastened together at the four corners, and having sway bracing in the shape of stiff floors once in eleven feet from the foundation to the top. To prevent the contraction and expansion, sure to be present in a mass of such huge proportions, it is wrapped, so to speak, with a thick covering of a non-conducting substance and this in turn by a thin veneer of stone. This stone is prevented from settlement by being carried by shelves at each story; making each twelve feet in height independent of the balance of the stonework and reducing the settlement to virtually nothing. As a further safeguard — careful, and I think accurate calculations show the entire weight of the structure to be less than one of the same area twelve stories high and built in the usual manner.

As to the cost, which you seem to think would be excessive, considering the result, the estimates of the various contractors show it to be about fifteen per cent less than an ordinary building of the same dimensions.

The solicitude which you display for the nerves of the tenants, I think hardly warranted as, owing to the peculiarly ridged construction, the effect of the ordinary earthquake would, presumably, produce only a motion akin to that of the mast of a vessel at sea, and a shock which might overturn the building would have of a certainty arranged the surrounding buildings as a nice soft spot for it to fall upon.

As to the matter of the man falling from one of the upper stories — I do not think that the party would very much care whether he fell from the twenty-eighth or the eighth story, and, in case he did, we probably should not know it unless by spiritualistic media.

Very respectfully yours, L. S. Buffington.

"GIANT METAL."

Bridgeport, Conn., November 20, 1888.

To the Editors of the American Architect:—

Dear Sirs, — We do not think you properly represent us in the statement on page 228 of "*The American Architect and Building News*" that the "Champion" Metal is probably the same essentially as our "Giant" Metal. The Smith & Egge Mfg. Co., *claim* that "Giant" Metal *is essentially* different in its *superior* fibre and antifrictional qualities, and claim, also, that their "Giant" Metal which is rolled exclusively for them, costs about forty per cent more than any ordinary metal before it is made into chain. We only suggest that you publish what *we claim.* We do not ask that you should vouch for it, we know it to be true, however, and take exceptions to your admissions that Champion metal is probably the same.

Respectfully yours, The Smith & Egge Mfg. Co.

SOME INITIAL CUTS.

Hartford, Conn., November 17, 1888.

To the Editors of the American Architect:—

Dear Sirs, — Will you kindly explain the interesting initial cuts on pages 206, 208 and 209 of your issue dated November 3?

Yours very truly, H.

[As the titles of these cuts were unintentionally omitted we are glad that H. has asked his question. The cut on page 206 shows an iron door-knocker and bell-pull handle at Nuremburg; the cut on page 208 shows a typification of the Trinity as painted on the wall of St. Pol de Léon. The cut on page 209 is styled the "Altar of the Twelve Gods" by the author of "*La Vie Privée des Anciens*" from which we borrowed it. — Eds. American Architect.]

TO DEMAND A CLERK-OF-WORKS.

Boston, Mass., November 12, 1888.

To the Editors of the American Architect:

Dear Sirs. — We want to thank you for the editorial in the *American Architect* for November 10, on the question of "clerk-of-the-works." The subject has been uppermost in our minds for some time, and we have arrived at a point where we have decided to make a break whether the others follow us or not, and frankly say that we do not superintend and that we are not paid enough for the work that we do. We feel that most architects pretend to superintend although they say they do not. Your remark some time ago that "an architect spent his time running about from town to town to see if his work had tumbled down since he was last there" first set us thinking. Then Mr. Atkinson's letter as to "Why architects did not show more energy in looking into new methods of construction," the editorials in the *Engineering Record* on the "Compensation of Architects," and the controversy over the Washington tower have all, in our mind, been due to the same cause: that is, that the architect of to-day is called upon to do so much for so small a price that he is compelled to neglect his work or starve.

We have written a new schedule which we propose to have well discussed before printing it, and which P— & Q— are now mulling over and they propose to join hands with us. Curiously enough, when going into Z—'s office to talk the matter over with him, we found X— there for the very purpose of discussing the question of compensation of architects, so that you see there is a strong current in favor of the new movement. Your editorial seems to us extremely well put. All classes of work must receive daily superintendence even if confined to a short period of each day, and all important work should have and must have a clerk-of-the-works constantly on the ground. We could enumerate no end of botches, careless work and criminal work which occurs and goes uncorrected simply because the architect does not see them, while the owner feels that everything is all right because the architect is looking after it, and the architect feels easy in his mind because, he says, "I am not paid to see every brick laid and every nail driven."

In our office when we stated to a client that a contractor was dishonest, whom he wanted to have figure on his work, he coolly said,

"Well, what is the advantage of having a reliable architect if he is not to look after a dishonest contractor?"

Let us all pull together and make the public come to us.

Yours very truly, ——

COMMISSION ON A PARTY-WALL.

November 17, 1888.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Will you kindly favor us with your advice in regard to the following:

Two land owners who we will call A and B, own adjoining lots and agree that A shall build a party-wall and B will pay one-half the cost of same. A employs architect Y, who makes plans for his building and lets the contract for building the same, including the party-wall. B employs architect Z, who makes plans for a building on the adjoining lot, showing one-half the party-wall and arranges vent and smoke flues, corbles and ledges, etc., on his side of the wall which are built according to his plans and directions. Now the question is: Has architect Z a just and legal claim for commission on that part of the party-wall which is a part of the building for which he has made drawings, etc., but at the same time contracted for by architect Y? A reply would greatly oblige, Y & Z.

[IT is usual to pay the architect of each building a commission on the cost of the party-wall, so that this part of the building pays two commissions which is fair, since each architect must go to considerable trouble in looking out for his side of the party-wall. Whether each architect gets commission on the value of the whole wall, or only on the half that his client uses, is decided by circumstances. It is quite common for the owner who builds first, and who, of course, builds the whole wall, and pays his architect the usual commission on the full value of it, to charge his next-door neighbor, when he settles with him for the joint use of the wall, one-half of the architect's five per cent on the cost of it, as a part of its value. The second man then pays his architect five per cent on the cost of his half of the wall only. In this case the first architect receives his fee for the whole value of the wall, and the second for only half of it, which seems to us a very good arrangement, as the first architect superintends it, and thus performs an important service for the owner of each half of it, while the second architect only has to adapt to his plan, what is already built. — EDS. AMERICAN ARCHITECT.]

THE PRESCOTT DOOR-HANGER.

CHICAGO, ILL., November 26, 1888.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Please note that in your article on door-hangers, commencing on line nineteen, first column, page 219, November issue, you say: "The only objection to their use for parlor-doors, is that they have to be put in before the plastering is applied and they are somewhat less easily adjusted." In answer we say:

Our hanger "The Prescott" is the only one that is never applied, even in part, (all other hangers must put in track) before the plaster is put on, and is, further, the only one that can be put on old doors without disturbing plaster. Every day we take off the track hangers from old sliding-doors and apply our hangers instead, without disturbing the plaster or anything else. We do not drive a screw in the pocket, but do *all* our work on the face of the jamb.

It takes our carpenter from ten minutes to a half hour to adjust our hangers when the doors do not work freely, and so seldom is this at all necessary that we guarantee our hangers (in all cases where we apply them) to work smoothly and easily for at least five years from date they are applied; and always repair, free of cost, any of our hangers that may be faulty in their working.

We think in common justice to us you should contradict this statement, as, from the large circulation of your paper, it will do us much harm. We had a case in point to-day — a gentleman building here looked over your paper to find proper materials for his house — seeing your article on door-hangers he decided from the clause above quoted not to use the Prescott. However, we finally convinced him of your error and he will use the Prescott Hanger.

Yours truly, PRESCOTT HARDWARE & MFG. CO.

NOTES AND CLIPPINGS

MALMAISON. — Malmaison, the famous château of the ill-fated Josephine de Beauharnais, is simply going by piecemeal to the dogs, or rather to the rats, and it has been admirably suggested that the place should be converted into a museum containing historical relics of the First Empire. In the beginning of the present summer Malmaison was offered for sale at an upset price of £10,000; but no bidder could be found. The park is now let out in small lots to builders, and hideous villas are arising around the château. The two façades of the mansion — that of the court-yard and of the garden — are intact, but the interior is like a barn. The *salon* of Josephine still exists, with its mural decorations of birds, and gilt flowers; and so do the dining-hall, the council-chamber — shaped like a tent — and the library; but the furniture is all gone, and the "pleasure-house" of old, is a melancholy wreck. It is to be hoped (the Paris correspondent of the London *Telegraph* remarks) that something will be done for the place in view of the approaching exhibition; for Malmaison was given to the State by Napoleon III, and was converted into a "Napoleonic Museum" during the World's Fair of 1867. The spot will be an interesting place of pilgrimage for the visitors to the exhibition, for Malmaison is to many more memorable than the Trianons at Versailles. Malmaison saw the triumph, the downfall, and the death of the "creole girl," who became Empress of the French. It was there that Josephine presided over the Consular Court, and it was thither that she repaired on the 15th of December, 1809, when the divorce was promulgated at the Tuileries which gave her place to the Austrian Archduchess. There, too, Josephine died in May, 1814, while Napoleon was at Elba; and when the conqueror himself was defeated at Waterloo, it was to Malmaison that he repaired, amid disaster and desolation. The property called Petite Malmaison is luckily in good hands. It is the summer seat of the Count de Bari, brother of the ex-King of Naples and of his Countess. The new occupant of the place has refurnished it in First-Empire style and has paid particular attention to the garden, in which Josephine used to amuse herself by planting flowers or pruning leaves. In this garden is still extant the gate through which Napoleon passed when he left Malmaison forever on his way to Rochefort, in order to give himself up to the English and to embark for St. Helena.

THE LATE T. GAMBIER PARRY. — Many of our readers will have heard with great regret of the death, on the 28th September, of Mr. T. Gambier Parry, at his house at Highnam Court. Mr. Parry was, as every one knows, one of the most noted and gifted of the band of amateur ecclesiastical artists and art-lovers who were part of the production of the great church revival movement of this century. Mr. Gambier Parry, however, was more fully and truly an artist than most of his compeers in the same band. His decorative painting at Ely Cathedral was a very important work, as well as his decoration of the church which was built at his own cost at Highnam; and his development of the spirit fresco process of painting was an important practical contribution to the technique of the art. It must be admitted, however, that the work at Ely and Highnam must be judged by a different standard from that which we apply to the leading artistic work of the day; it is essentially amateur painting, though amateur painting of an unusually high class. Mr. Parry's rather recently published volume of artistic essays[1] contained much beautiful writing on art, and is the index of a highly refined, sensitive and cultivated mind. Mr. Parry's personal manner and appearance harmonized remarkably with his artistic repute: he impressed one, as we heard it remarked, with the idea that he was one of the Italian Renaissance artists come to life again in the nineteenth century. He leaves a wide circle of friends by whom he will be regretted, both on public and private grounds. — *The Builder.*

PERSONAL EXPERIENCE OF AN ELECTRIC SHOCK. — Thinking some of the readers of *The Electrical World* might be interested in a personal experience of a shock by an intermittent current, I will give an account of one that occurred to me. On touching two terminals to close a circuit on some experimental apparatus, I thought of course I had grasped the insulation, but the bare end of a flexible wire managed to touch my right-hand fingers while I held the binding screw in the other hand. I was instantly thrown down and held perfectly rigid, unable to speak, it seemed to me, for two or three minutes, but probably twenty or thirty seconds would be nearer the actual truth. I felt unconsciousness coming on, when suddenly I became loosened and I lay perfectly limp a moment or so. I got up, but was scarcely able to walk, the pains being greatest in the hips. However, I got a voltmeter and found 140 volts on the circuit, and the alternations or intermittences were 150 per second, while I found my resistance, under the same conditions, to be 4,500 ohms. The wire that slipped out of my hand left a burn on my forefinger in the shape of an elliptical hole about 5-32 inch deep, and scarred the flesh about the hole at a radius of one-quarter inch. During the contact I felt difficulty in breathing, but five minutes afterward my skin was all aglow, as if a bath-brush and Turkish towel had been used vigorously, while the respiration became full and a trifle quickened. Two days afterward I was all right, except a little soreness all over. — *T. D. Bottome, in The Electrical World.*

ODE TO AN ELECTRIC LIGHT.

Twinkle, twinkle, little Arc,
Sickly, blue, uncertain spark;
Up above my head you swing,
Ugly, strange, expensive thing.

When across the foggy air
Streams the lightning's purple glare;
Does the traveller in the dark
Bless your radiance, little Arc?

When you fade with modest blush,
Scarce more bright than farthing rush,
Would he know which way to go
If you always twinkled so?

Cold, unloving, blinding star,
I've no notion what you are;
How your wondrous "system" works,
Who controls its jumps and jerks.

Yours a lustre like the day!
Ghastly, green, inconstant ray,
No; where'er they worship you
All the world is black or blue.

Though your light perchance surpass
Homely oil or vulgar gas,
Still (I close with this remark),
I detest you, little Arc!

St. James's Gazette.

[1] "The Ministry of Fine Art."

Frost-proof Mortar. — According to the *Bautechniker*, Herr Heinrich Hausleitner, of Vienna (Meidling, Schulgasse No. 13), by adding a certain substance, renders gypsum, hydraulic lime, and Portland cement perfectly frost-proof. The effect of the addition is that those materials, even during the most severe frosts, set without freezing. The frost-proof materials, which are stated to have been found efficient, are used in the following manner in mixing mortar: — (1) *Frost-proof Gypsum Mortar.* — Three parts of good white lime mortar are well mixed with 1½ or 2 parts of frost-proof gypsum, but the quantity mixed must be used quickly, and the interval from the time of mixing to using the mortar must not exceed ten minutes. (2) *Frost-proof Hydraulic Mortar.* — Three parts of sand are mixed with 1½ part of hydraulic cement lime, the necessary quantity of water is added, and the mortar mixed as quickly as possible, so that from the time of adding the water to the complete using up of the whole quantity of the mortar prepared no more than ten minutes elapse. If it is desired to add frost-proof hydraulic cement lime to white lime mortar, so as to cause the latter part to set and resist frost, one part and a half of frost-proof hydraulic cement lime is added to three parts of thin white lime mortar, the whole quantity of the prepared mortar to be used up within ten minutes of the time of adding the frost-proof hydraulic cement lime. (3) *Frost-proof Portland Cement.* — This is treated and used in the same way as frost-proof hydraulic cement lime. The frost-proof materials must be stored in a dry place, for damp causes them to stick to the barrel, and to become worthless for further use. — *The Builder.*

The Sound of Thunder. — One of the best descriptions of a common natural phenomenon is that recently given by M. Hirn, in which he says that the sound which is known as thunder is due simply to the fact that the air traversed by an electric spark — that is, a flash of lightning — is suddenly raised to a very high temperature, and has its volume, moreover, considerably increased. The column of gas thus suddenly heated and expanded is sometimes several miles long, and, as the duration of the flash is not even a millionth of a second, it follows that the noise bursts forth at once from the whole column, though for an observer in any one place it commences where the lightning is at the least distance. In precise terms, according to M. Hirn, the beginning of the thunder-clap gives us the minimum distance of the lightning, and the length of the thunder-clap gives us the length of the column. He also remarks that when a flash of lightning strikes the ground, it is not necessarily from the place struck that the first noise is heard. Again, he points out that a bullet whistles in traversing the air, so that we can, to a certain extent, follow its flight, the same thing also happening with a falling meteorite just before striking the earth. The noise actually heard has been compared to the sound produced when one tears linen. It is due really to the fact that the air rapidly pushed on one side in front of the projectile, whether bullet or meteorite, quickly rushes back to fill the vacuum left in the rear. — *Iron.*

A Gas Hammer. — John Bull uses a lot of iron in making tools, but he makes some mighty good ones — sometimes. A Scotch branch of an English machinery house has recently brought out a gas hammer which must prove very handy in the shop. Instead of steam furnishing the motive power, a mildly explosive mixture of common coal-gas and atmospheric air is employed. It is used to propel the hammer piston very much as in the cylinder of a gas-engine. Softer blows are given by reducing the range of movement of the hand-lever, and the force of the blow can be regulated as easily and accurately as with the steam hammer. The hammer is that known as the three-fourth hundredweight size, but the ordinary blow struck by it is equal to a weight of three hundredweight falling through a height of one foot; 3,000 blows only use thirty-three cubic feet of Birmingham gas which at 2*s.* 6*d.* per 1,000 cubic feet costs one penny, or 4,500 light and heavy blows can be struck for the same sum. The hammer is always ready for work at any moment, day or night, for short or long periods, and it works at the same economical rate for one blow as for 1,000. It is only necessary to light the Bunsen flame, open the gas-cock, and it is ready for action. The hammer is arranged to work with hand-gear, but if preferred it can be arranged to work with foot-gear also. Yankee ingenuity has no business to let cousin John get ahead. We can find an excellent use for gas hammers where there is no steam-supply available. — *The Boston Manufacturers' Gazette.*

Canada's Ship Railway. — Mr. Ketchum, engineer and promoter of the Chignecto railway, which is to connect the waters of the Bay of Fundy and straits of Northumberland, is trying to complete arrangements with the government in connection with his works, for which Parliament at its last session granted him a subsidy of $170,000 per annum for twenty years. Mr. Ketchum says that all contracts in connection with the enterprise have been awarded and operations commenced all along the line. The railway is estimated to cost $5,500,000, and is expected to be finished by September 1, 1890. Docks are to be constructed at either end for the reception of vessels before they are transferred to the railway. That at the Bay of Fundy end will be 300 x 600 feet, and the one at Chignecto will be 800 feet long, in addition to which there will be a lifting dock 200 feet in length. At the Bay of Fundy there will be an hydraulic lift which will lift and lower vessels forty feet. The construction of the docks will be more costly than that of the railway itself at Baie Verte, where the water is at present very shallow. The channel will have to be bridged at the Bay of Fundy, and there will be a gate to impound water sufficient to float vessels of twenty-five feet draught. The railway altogether will be seventeen miles long. When the vessels are lifted from the locks they will be placed upon cradles made to adjust to the side of the vessels, and these will extend over four steel rails of the weight of 110 pounds to the yard. Under a large vessel there will be about 200 wheels. — *Boston Herald.*

Oxford University. — The English University of Oxford has twenty-one colleges and six halls. The halls differ from the colleges in not being incorporated and having little or no endowments. There were at one time more than a hundred halls. The colleges are as follows: University, Merton, Balliol, Exeter, Oriel, Queen's, New, Lincoln, All Soul's, Magdalen, Brasenose, Corpus Christi, Christ's, Trinity, St. John's, Jesus, Wadham, Pembroke, Worcester, Hertford and Keble. The halls are: New Inn, St. Edmund, St. Mary, Charsley's and Turrell's. — *The Christian Observer.*

Sticking Paper to Metal. — Paper pasted, gummed, or glued on metal, especially if it has a bright surface, usually comes off on the slightest provocation, leaving the adhesive material on the back of the paper, with a surface bright and slippery as ice. The cheaper description of clock dials are printed on paper and then stuck on zinc; but for years the difficulty was to get the paper and the metal to adhere. It is, however, said to be now overcome by dipping the metal into a strong and hot solution of washing-soda, afterwards rubbing perfectly dry with a clean rag. Onion juice is then applied to the surface of the metal, and the label pasted and fixed in the ordinary way. It is said to be almost impossible to separate paper and metal thus joined. — *English Mechanic.*

TRADE SURVEYS

With scarcely an important exception, business in all branches has fallen off since November 6. No reasonable explanation has been offered by those writers who are ordinarily so quick to detect underlying causes. Prices have not suffered in any direction. Distribution at retail is progressing finely. The markets are all active. No advance will be made on standard articles of consumption for the spring. The point at present in dispute in trade and manufacturing circles is: Will prices decline between now and spring? This uncertainty is the real cause of the lull. So many interests are preparing to increase capacity and output, that buyers take both hope and alarm at the prospects. If there is anything to be gained by delay they intend to have it, and hence stocks of nearly all kinds of merchandise and raw material in second hands are going down, and are not being made up. This policy may continue up to the close of the year. Jobbers and manufacturers complain at it because it leaves them in the dark, whether to push business and accumulate goods or not. If they adopt the first alternative and manufacture ahead of orders, buyers will take advantage of this fact to crowd down prices under threats of buying elsewhere, and under intimidations that entirely too much has been manufactured. Manufacturing interests do not accept the possibility of lower prices, but, in many quarters, believe a higher range is probable. Dry goods, clothing, carpets, boots and shoes, hardware and house-furnishment remain where they were, though manufacturers have agreed to advance carpets two and one-half cents, which means ten at retail. The conviction among manufacturers is that an upward tendency will do harm, and in textile channels they are endeavoring to guard against the effects in the advance on wool at home and abroad. In the heavier industries, there is no room for doubt as to the future satisfactory condition of trade, excepting as to railroad building. Perhaps never before was as much engineering work on hand and contemplated. All our great machine-shops, car and locomotive works, and most of the merchant steel works continue crowded with orders. November railroad earnings show a falling off on fifty-nine roads of 4.16 per cent cotton exports to date, 1,365,432 bales, against 1,725,131 bales last year. Bread-stuffs exports are also far behind last year, the decline in flour being as 28 to 20, wheat 11 to 4. Traffic rates will probably be restored on many Western lines, though matters are far from being on a permanently friendly basis. A meeting of trunk-line presidents was held at New York this week. The inactivity in funds is shown in an increase in surplus reserves at New York to double the amount held a year ago. Currency is equal to all requirements, and foreign investments continue on a liberal scale.

Leading agricultural and implement manufacturing authorities West have expressed the belief that there will be a greater increase in the agricultural area next year than ever. Farmers and cotton-planters are buyers of and lookers after a great deal of special machinery and appliances. The leading agricultural-implement people West and Southwest of St. Louis are preparing for a good year. Possibly, the activity is no more than what is usually to be expected, but it is of such a magnitude as to excite comment. Another evidence of healthful conditions is the active demand for crude iron, especially in the West. Southern furnaces are selling all they can make. Of course, the possibility of getting ahead of the market is always to be kept in sight. Users of copper are watching syndicate operations with increased interest, in consequence of the accumulation of European stocks from 48,503 tons October 1, 1887, to 93,988 tons November 1. They do not lose sight of the fact that new sources of supply are adding to the stock available. Observers of commercial and industrial movements have, of late years, been struck with the timely action of recuperative agencies that come just when needed to prevent or allay some evil threatened. Last spring, as if with one accord, production was widely restricted and with advantage to all interests; a like dulness has set in at this time, but it may not last longer than the holidays. The greater controlling intelligence prevents blind expansion and production. Meanwhile, new interior markets are being developed and the purchasing-capacity of the people at large is greater. This self-correcting tendency is noticed by those who control aggregated wealth and capital, and it strengthens their confidence in the prosecution of new enterprises. New York financiers say that the conditions are more inviting for enormous investments in industrial channels than they ever have been, and reputable railroad authorities in Boston predict that within a few months American investments in railroad securities will increase very much. Much, they say, depends upon the harmonizing of the theory and the practice of railroad legislation. The railroad interests are at present passing through a trying ordeal, and if railroad managers can obey the laws and prosper, a new field for investment will open up. There are signs of movements among various branches of manufacturers to perfect their organization and to extend them into new manufacturing sections. What has been gained will be rendered secure. Manufacturers see great advantages in future political contests by bringing the new industrial communities up to their standard. An educational work will be carried on as far as possible so that the leverage of the mere politician will be shortened through greater enlightenment when it comes to decide again what shall be the fiscal policy or the economic policy of the Government.

S. J. Parkhill & Co., Printers, Boston.

The American Architect and Building News

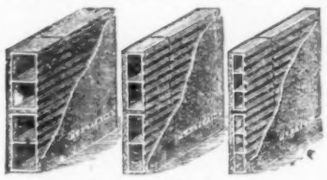
ADVERTISERS' TRADE SUPPLEMENT.

No. 78. SATURDAY, DECEMBER 1, 1888. Volume XXIV. No. 675.

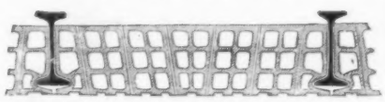
RARITAN HOLLOW & POROUS BRICK COMPANY.

This Company, as its name implies, makes a specialty of the manufacture of hollow-brick and porous terra-cotta for fireproof buildings.

The use of these materials for fireproof-construction has become so universal that it is scarcely necessary to describe them. The accompaning cuts show the usual forms of hollow-brick for fireproof floors and partitions.



Hollow-brick Partitions.



Flat arch between iron beams, with skew-back protecting lower flange of beams.

In addition to these, blocks or slabs of porous terra-cotta are made for wall-furring, column-covering, roof-lining, etc. The porous terra-cotta can be easily cut and fitted, and will receive and hold nails so that slate or other roofing can be nailed directly to the roof-blocks.

The Raritan Hollow & Porous Brick Company was incorporated in 1882, and at once secured a large share of the trade in this line. Since then their business has steadily increased so that it has been necessary to enlarge the plant each year, and at the present time it is, without question, the leading firm in the trade.

They make a specialty of large contracts, and have every facility for furnishing large quantities of materials at short notice.

Among the more important buildings for which they are now furnishing the fireproofing materials, are: United States Trust Company's Building, New York City; Bank of America Building, New York City; United States Army Building, New York City; American Museum of Natural History Building, New York; Fidelity Title & Deposit Company's Building, Newark, N. J.; Girard Life Insurance & Trust Company's Building, Philadelphia, Pa.; United States Court-House and Post-Office Building, Reading, Pa.; New York Life Insurance Company's Building, Montreal, Canada; Canadian Pacific Railway Station, Montreal, Canada; City-Hall, Fall River, Mass.

The Company has also lately added a department for the manufacture of buff front-bricks of various shades and fire-bricks of all grades.

Illustrated catalogues will be sent on application to

THE RARITNN HOLLOW & POROUS BRICK CO.,
115 Broadway, New York City.

The Whittier Machine Company, have recently constructed for the Yale and Towne Manufacturing Company, Stamford, Conn., an hydraulic freight-elevator.

THE CHROME STEEL WORKS, BROOKLYN, N. Y.

The city of Brooklyn, N. Y., though it cannot be classed with Pittsburgh and like cities, as a great centre of the steel industry of the country, is certainly entitled to a place of distinction in this particular. The steel-manufacturing interests of this city, have increased wonderfully of late years. One of the representative concerns of this character located in Brooklyn, is the Chrome Steel Works, established in 1867 on Kent Avenue, Keap and Hooper Streets, and of which Mr. S. H. Kohn is the president, and Mr. C. P. Haughian, vice-president. The foundry, rolling-mill, melting, hammer and other shops, which heretofore covered nearly two acres of ground, were enlarged in the spring of 1887, and gas was substituted for coal in the heating and melting furnaces. The new plant necessary for this change was made complete in every respect, even to the gas generator for the manufacture of the gas used, and the productive capacity of the works was increased two-fold. Another advance step was taken this year when it was found necessary to have additional "rolling" facilities, and the works were further enlarged by the addition of a wing 80 x 150 feet. The establishment now presents an imposing appearance and takes rank with any of its class in this country or abroad, and here is turned out in large quantities the well-known "Chrome Steel."

Ordinary or carbon steel is a compound of iron and carbon, the proportions of carbon being from 0.5 to 1.5. It differs from iron merely in the amount of carbon contained in it, and so we see carbon steel is more a condition of iron, than a distinct metal. To demonstrate how closely iron and steel are related, it is only necessary to mention that whereas cast-iron contains about 3.5 per cent of carbon, and malleable-iron contains 0.4 per cent, carbon steel contains about 1 per cent; thus being a sort of intermediate between cast-iron and malleable-iron. Chrome steel differs from carbon steel in the substitution of chromium for carbon in its manufacture. It is an alloy of chromium and iron, the proportions of which are accurately weighed and scrupulously exact in every grade; both metals, uniting perfectly in alloy, become integral in their unity, producing a uniform steel, which it is claimed is much superior to the carbon steel. Though it is an easy thing to claim superiority over competitors for almost any article of manufacture, it is seldom however, as easy to establish the correctness of the claim. In this case the superiority of "Chrome Steel" is readily recognized, and lies in the fact that, when properly hardened, steel made in this way *cannot be cut* by the finest saws, drills or chisels, as it is much harder than such tools are made. It is exceedingly tough when hardened, and will not deteriorate by the continued application of great heat, and unlike carbon steel may be worked in large masses, with perfect reliability — a quality of vital importance in the general use of steel. It has been favorably reported upon by the authorities at the United States Navy Yard, Washington, D. C., who after having subjected it to severe tests, say, in the course of a letter to the manufacturers, enumerating its good qualities: "It will do from three to four times more work in all the various kinds of tools than carbon steel will." Chrome steel may be made quite ductile and soft by using chromeisen instead of spiegeleisen in the Siemen's steel process, where the resultant may be tempered to several grades of hardness within well defined limits. It is capable of being welded and worked as easily as wrought-iron, while it may be made into all the various forms required for machinery without the danger of being destroyed by over-heating. Its adaptability for manufacturing purposes is apparent. The Chrome Steel Works, manufacture what is known as their "Chrome tool-steel, in rounds, squares, octagons, and irregular shapes. This is very desirable for making tools and like purposes. A boring tool of Chrome steel, properly proportioned and tempered, will stand to bore and turn cast-iron or other metal that is too obdurate to yield to the persuasions of the best tempered and "highest" grade of carbon crucible steel, made from the best iron.

A large fly-wheel for a special purpose with a narrow rim, and thirty-two feet in diameter, was found to be so hard on its "face" that it could not be turned with tools of the best carbon steel. Grinding and clipping were attempted, but the surface was like glass, and resisted all efforts. Tools of Chrome steel at last compelled the iron to yield and a costly

casting was thus saved. This is but one of the many instances in which the superiority of Chrome steel as a tool steel, has been most strikingly and satisfactorily demonstrated.

As this material when properly hardened will not yield to the saw, drill, hammer or chisel, it is found extremely desirable for window-guards, gratings, doors, and other constructions where absolute safety is not alone desirable, but necessary.

The manufacturers of this popular product, also make besides their regular tool-steel, what is called their five-ply combination plates, consisting of alternate layers of welded Chrome steel and iron. This material has met with much favor among architects, builders and bankers for burglar-proof vaults, and safe manufacturers have found it singularly well adapted for making burglar-proof safes. A jail or prison the cells of which are constructed of this material may be truly said to be positively jail-proof, as it is really impossible for the most expert jail-breaker to work his way through it, whatever means he may employ. We also find Chrome steel turned to good account in the manufacture of the celebrated Adamantine shoes and dies for stamp-mills, now used extensively with the most flattering results throughout the mining regions of both North and South America. It is proved in using these goods that the wear being so very slight, little if any of the metal combines with the amalgam or becomes mixed with the crushed ores, thus saving the precious metals from an admixture that, as all millmen know, is so injurious to free amalgamation. Shoes and dies made of Chrome steel will not "cup," neither will the shoe break at the shank. Both shoe and die wear even from end to end, thus crushing in a given time from fifteen to twenty per cent more ore than shoes and dies made of cast-iron, which invariably wear unevenly. The manufacturers also have evidence that they outwear three sets of those made of the best cast-iron. They also manufacture tappets, cams and bosses for stamp-mills, and crusher-plates and shell-rolls, used in the crushing of ores and rock, and also cast to pattern in all shapes such as crank-shafts, gears, pinions, stamp-dies, parts of steam-pumps and hydraulic-presses. The best and withal the most satisfactory way for our readers who are desirous of learning still more regarding these works, would be to visit them, and see for themselves the enormous quantity of steel that is produced and furnished by

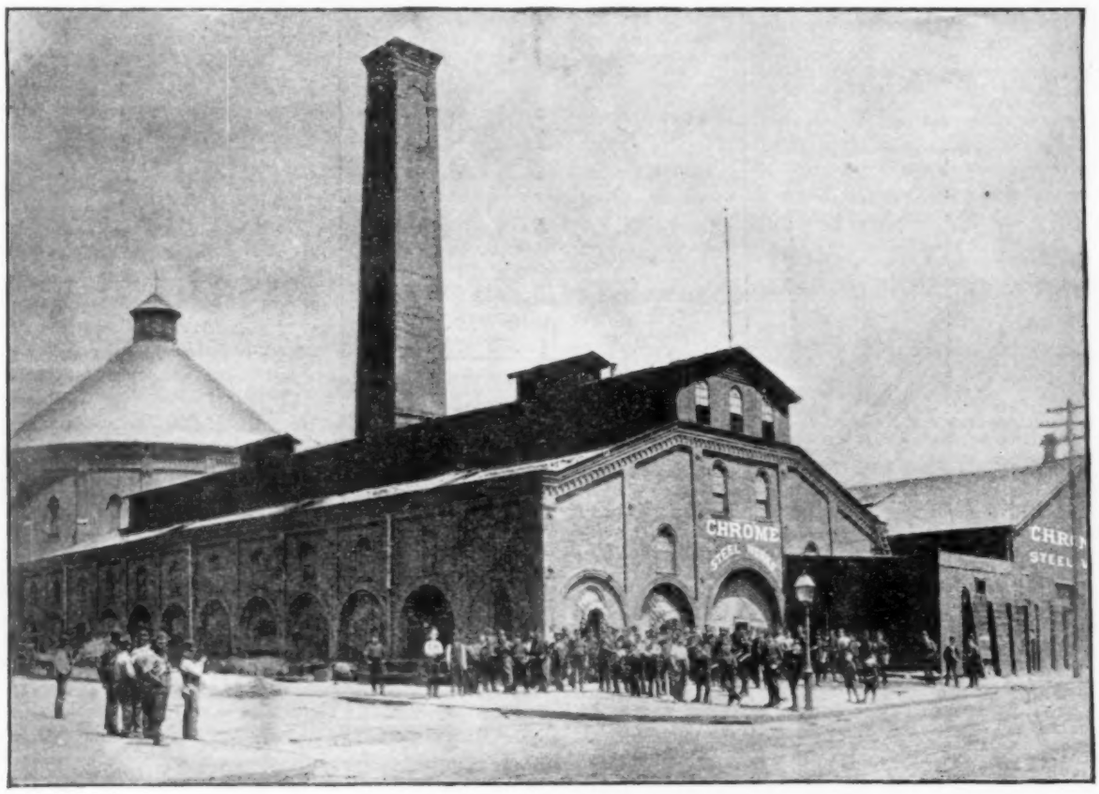
THE CHROME STEEL WORKS,
Brooklyn, N. Y.

THE ECONOMY FOUNDRY.

On June 4th, last, the J. F. Pease Furnace Company, of Syracuse, N. Y., bought a piece of property in that city, of about 240′ x 210′ in dimensions, situated three-quarters of a mile from the Company's main works on Willow Street, and about the same distance from the centre of the city. The property is located on the corner of Belden Avenue and Sand Street, one block north of West Genesee Street, and fifty feet south of the main line of the West Shore Railroad. One week after the purchase, ground was broken for the erection of a foundry, pattern and machine shops for the Economy Foundry Company, a concern organized some time previous and composed of Frank A. Austin, draughtsman, Jno. Aldinger, machinist, William H. Brown and M. C. Reddin, foundrymen. On September 15th, a little over three months after its commencement, the plant was practically completed and the first iron was successfully melted. The buildings erected cover about one-half of the lot and were especially constructed by the Pease Company to increase its facilities and enable it to meet the constantly increasing demand for the Economy Combination Heater and Economy Warm-Air Furnaces, which the Company manufactures exclusively. The plant consists of a two-story main building of brick, with the foundry and sand-bins adjoining on the east, built of wood, a large portion of which is Georgia pine. The foundations of the buildings lie at the foot of the West Shore Railroad Embankment, so that a switch from that road runs directly to the second story of the buildings, affording excellent facilities for receiving iron and coke into the cupola-charging and coke room, and for the shipment of finished castings from the works. The switch also runs to the top of the sand-sheds, on which there are twelve chutes for distributing the sand into the bins. The switch is provided with an Improved Fairbanks Car Scale.

The foundry-room is covered by a roof made from the special design of Mr. Frank Austin, of the Economy Foundry Company, and was planned with a view of distributing the rays of light in such a manner as to thoroughly light the foundry-room in every corner. On dark and cloudy days the light is intensified with the effect of making the interior many degrees lighter than the outside. This experiment of Mr. Austin's has been a great success, and the Pease Company boasts of having the lightest as well as the best-equipped foundry in Central New York. (Annexed cut of transverse sectional plans shows angles of the roof, etc.) The windows on lower angle of the roof are pivoted in the centre of top and bottom, and when open admit same amount of light as when closed. The windows on the upper angle are alternated with ventilators.

The cupola, made from the original design of Messrs. Brown and Austin, has a total height of forty-four feet and inside diameter of sixty inches — shell of $\frac{5}{16}$ wrought-iron — height from bottom to charging-door on the second story, twelve feet. The wind-belt on the outside of the shell is connected by two side pipes of eleven inches in diameter with the main blower pipe, of eighteen inches diameter,



CHROME STEEL WORKS.

which is supplied by one No. 8 Sturtevant blower made by B. F. Sturtevant, Boston. The inside of the wind-belt is connected to the inside of the cupola by two rows of eight tuyeres each, the lower row being fourteen inches from their centre to bottom of the cupola, and the upper row sixteen inches from centre to centre of lower row. The cupola readily melts ten tons of metal per hour. The foundry-room is supplied with two large cranes of fifty-four-foot radius and twenty-seven-foot jibs, which together with the side-trams are ample to handle castings in every portion of the room. On the east side is a core-room containing two large core-ovens, one accessible by the cranes for heavy work.

As shown in the annexed plans, the general and private offices are located in the south-west corner of the first floor of the main building and well away from the noise of the machinery in the works. The large shipping-room of 60′ x 70′ is ample for its purpose, and is equipped with a Fairbanks Dormant Scale, while the south shipping-door opens onto a large wagon scale of the same make. The motive power for the plant is furnished by a sixty horse-power boiler made by the Phœnix Foundry Company, of Syracuse, and a fifty horse-power engine made by the Straight Line Engine Company of the same city. The boiler is provided with a Herrick Pump Governor and fed by a Stuart Pump, made by the Stuart Heater Company of Buffalo, and the water is heated by a Berryman Heater, made by Davis & Son, Hartford. The machine-shop is equipped with an eighteen-inch drill, and a thirty-six-inch back-geered drill, made by Prentiss Bros., of Worcester, two lathes made by Forsyth Machine Company and E. Remington & Sons, and a No. 6 diamond emery wheel.

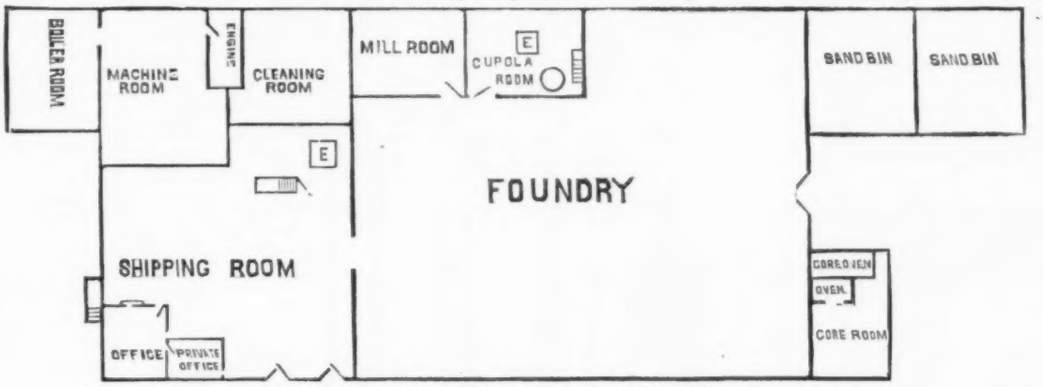
The wood and pattern shops, 100′ x 70′, which occupy the whole of the second floor of the main building, are provided with a thirty-four-inch Clements band-saw, a twenty-inch Clements buzz-planer, a sixteen-inch Clements swing-saw, a Mosely planer, a twenty-four Clements pattern lathe with twenty-two-foot bed, an eighteen-inch Prentice drill, a No. 2 rip-saw, made by Wetherby, Rugg & Richardson, and a standard diamond emery grinder. In the mill-room are used two each twelve, sixteen, twenty and forty inch mills, and in the cleaning-room No. 7 diamond grinders with two 2½″ x 20″ wheels.

The whole building is heated throughout by exhaust steam from a plant furnished by E. P. Bates & Co., of that city, which heats 2,700 surface feet of radiation. The entire plant, excepting the foundry-room is protected from fire by Automatic Fire Extinguishers made and erected by the Providence Steam & Gas-Pipe Company and connected to a tank of 5,000 gallons capacity situated on top of the foundry roof. The extinguishers are also supplied from four-inch city mains.

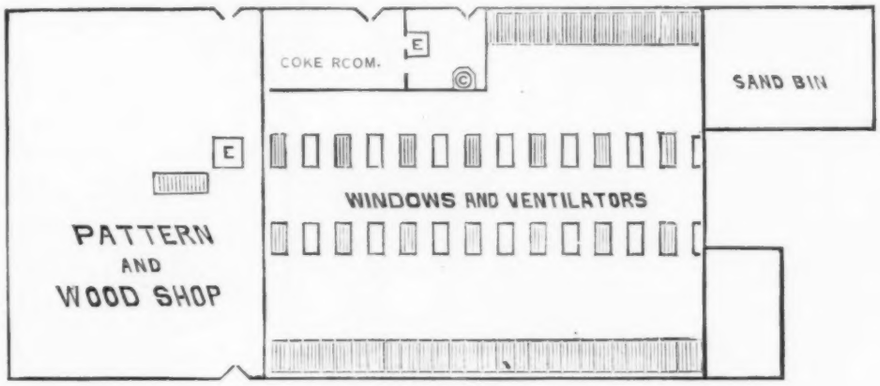
The shaftings, hangers and couplings were furnished by L. S. Graves & Son, of Rochester, and have been so arranged that 112 feet of main-line shafting on the first floor drives all the machinery on the two floors of the building. The water for the boiler is supplied from a cistern of 1,000 hogsheads capacity, situated under the machine-shop. The buildings are to be lighted by electric light from a plant in the works. Two elevators made by E. W. Houser of that city, are used in the building.

The Economy Foundry Company will make all of the castings for the Economy Furnaces and Heaters, and will also make a specialty of contract-work for all kinds of gray-iron castings, draughting, designing, pattern-work, machine-work, etc.

J. F. PEASE FURNACE COMPANY,
SYRACUSE, N. Y.



FIRST FLOOR OF J. F. PEASE FURNACE CO.'S NEW FOUNDRY.



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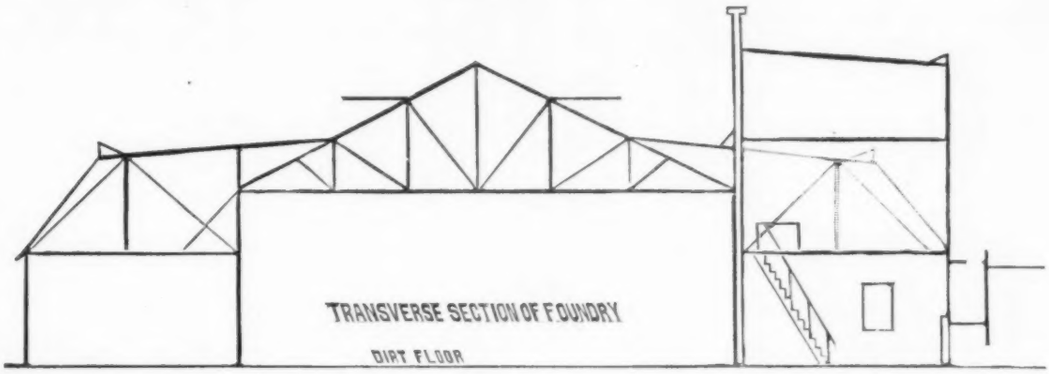

THE Whittier Machine Company have recently put into the New England Hospital for Women and Children on Dimock Street, Roxbury, an hydraulic passenger-elevator.

"STUART" DOOR AND WINDOW SCREEN.

As we review our business of manufacturing the Stuart Window and Door Screen for the two years past, the comprehension of its enormity not only impresses us, but we are amazed by the unique, if not marvellous phases that the facts present; and as one peculiarity generally suggests others, we pursued them with some interest, though to a somewhat extreme length, and we doubt not a short narration, presenting them as they occurred to us, will interest your readers.

Manufacturing the Stuart Window and Door Screen was commenced by us in 1886, though our business of that year was scarce more than a beginning, our sales were small compared to later developments, but they very soon increased in volume, necessitating an almost immediate revolution in our modes of manufacturing, demanding at once new machinery of the most improved pattern, many times doubling the number of workmen at first employed, requiring new and larger buildings, crowding us to adopt new and quicker methods, so, that at the end of the second season we found, instead of one article simply added to our line, we had actually added an industry complete in itself, the volume of which may be clearly comprehended by a perusal of the following deductions obtained from our books showing all sales to October 1, 1888.

The sales of the screen-frames (as of every article in our line) are recorded in books, specially gotten up for the purpose, and they will show sales of each day during the year, they being posted daily, so the accuracy of the following facts are vouched for by us. The number sold to date mentioned, of the "Stuart Window-screen" is 386,220 sets, which would supply 64,370 dwellings, allowing six screens to each; and of the "Stuart Doors," the number sold is 75,768, which would provide screen-doors for 37,884 dwellings, allowing two doors each.

In lineal feet the moulding used for windows amounts to 12,081,840 feet, and of the doors the moulding measures 3,077,088 lineal feet, — in miles the total is something more than 2,871, and being laid end to end would reach from New York City to San Francisco, or from Victoria, B. C., to the City of Mexico.

We have made, for use on the same, of the Stuart Door and Window corners 214,889 pounds, or 107 tons of castings, which taken together with the frames make a total weight of 2,771,129 pounds, or 1,385 tons, to move which would require 138 freight cars of ten tons capacity, that amount being an average carload on account of the bulky nature of the goods.

The windows are packed in cases containing three dozen each — size 44″ x 18″ x 18″, requiring 10,728 cases. The doors are packed in cases of one dozen each — size 96″ x 9″ x 15″, requiring 6,314 cases for the doors, making together 135,861 cubic feet, from which a column twenty-five feet square and over 200 feet high could be made — all of finished frames ready for shipment.

Indications point to a vigorous increase in business the coming season, and our present space being inadequate, we are taking steps to provide for it, and have in course of construction large and commodious warehouses especially arranged for this branch of our industry.

E. C. STEARNS & CO.,
SYRACUSE, N. Y.

RIEFLER'S DRAWING INSTRUMENTS.

It is a well-known fact that in order to produce satisfactory results the mechanic must have good tools. For the draughtsman it is of the utmost importance, in making detailed plans to have strictly accurate and reliable drawing instruments, as poor tools will cause an endless amount of annoyance as also expense. We have secured the United States Agency for Riefler's celebrated drawing instruments, which, although comparatively new in this country, have already gained the highest reputation for excellence in workmanship and advantages in form and construction. Every architect, mechanical draughtsman, engineer and others should examine these goods and be convinced of the superiority over the ordinary style of mathematical instruments.

Fig. 2.

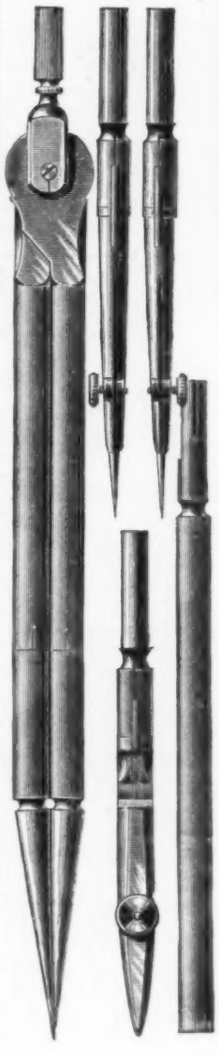

Fig. 1.

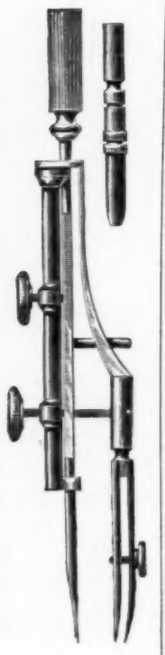

Fig. 3.

Figures 1 and 2 show the construction as applied to a drawing compass. The legs of the instrument are cylindrical thus increasing the strength, while the amount of material and space occupied is not greater. The points are cone-shaped and screwed into the eyes with the utmost accuracy, and can therefore be replaced when necessary, at a small cost. The needlepoints are of very hard steel of same size as an artist's lead, which can be substituted at pleasure since they are of equal diameter.

A very important improvement over the ordinary drawing instruments is the formation of the joints. A portion of the cylindrical leg is reduced in diameter and split to effect a tight joint with a wedge provided to prevent turning. This is made to fit a corresponding socket of same diameter, thus forming a uniform surface on outside with joint scarcely noticeable. The manner of construction is so perfect that the parts cannot easily wear out, and the projecting screws together with the annoyance of losing same, are avoided. The shifting of legs of instruments while in use is avoided by the means of screw clamps. The illustrations represent the exact size of instruments both of which will produce equally fine small work.

The Bow-compass (Figure 3) is very desirable for describing minute circles and can be adjusted to suit the requirements of the draughtsman.

Of the other instruments we might also mention the *Dotting-Pen* which is of same remarkably fine finish. These are furnished with either three or six wheels of standard designs. The Ruling-Pens are of finest possible workmanship and each carefully examined before leaving the factory.

All persons requiring reliable and accurate instruments, should examine these goods as they are second to none in quality, while their construction offers decided advantages.

Weed's T-square Holder, for which Messrs. F. Weber & Co. are also agents, is an ingenious contrivance and of great value to every person using a T-square. The slipping of square is thereby avoided, while it enables the draughtsman to hold board at an angle.

Illustrated price lists will cheerfully be sent to any address, by

F. WEBER & CO.
PHILADELPHIA, Pa.

NOTES.

It is not generally known that the Chalmers-Spence Company, N. Y., well-known manufacturers of Asbestos goods, have lately put upon the market a new patent removable covering styled their Class "C" Covering. It is formed of pure Asbestos fibre, in cylindrical sections, three feet in length of the exact size of the pipe to be covered, and is made by a special and improved process of manufacture. It is destined to become very popular with steam users.

The Chrome Steel Works, Brooklyn, N. Y., are kept busy filling orders for their well-known Chrome Steel manufactures. Their five-ply combination plates, consisting of alternate layers of welded iron and Chrome Steel, are used largely in the construction of safes, banks, safe deposit vaults and cells of jails. This material is absolutely fire and burglar proof.

The Whittier Machine Company have recently put into the Mt. Kineo House, Me., a new steam hoisting machine for their elevator, and have recently constructed for the Dover Water Works, Dover, N. H., two horizontal steel boilers, each five feet in diameter.